

SELECTED DIETARY AND PHYSICAL ACTIVITY
BEHAVIOUR AMONG A GROUP OF ADOLESCENTS IN
NAIROBI, KENYA

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of Master of Health Science

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ABSTRACT

Worldwide, there is a growing burden of non-communicable diseases (NCDs). The rise has coincided with the increase in prevalence of overweight and obesity. The ANGELO framework recognises the role of environmental influences in weight gain. In Africa, various environmental influences have led to shifts from traditional dietary patterns and more physical lifestyles to a “Western” dietary pattern and low physical activity. The life course perspective posits that excessive body weight can persist from adolescence to adulthood, and increase the risk of NCDs. Among adolescents the school environment is a crucial setting for the development of and, or engagement in unhealthy dietary and physical activity behaviour.

The aim of this thesis was to investigate in the school environment, the consumption of energy dense foods (EDFs) and energy dense beverages (EDBs) as are typical of a “Western” dietary pattern, and physical inactivity among a sub-group of adolescents in Nairobi, Kenya. Also, the sources of food in the school environment, and the attitudes to the importance of diet and physical activity for health were assessed. A cross-sectional survey was conducted among 402 adolescents aged 13-19 years. The adolescents were recruited from schools that cater to students from households likely to be of at least middle-income socio-economic status. Results indicate that the majority of adolescents reported the consumption of an EDB (82.3%) and EDF (88.3%) at least once during the school day. Nearly half of the adolescents consumed a meal sourced from a school lunch program (45.9%). In terms of weekly consumption, the items that were reported as frequently consumed by the highest proportion of adolescents were sugar sweetened beverages (46.5%), and pastries such as biscuits and cakes (38.8%). Both the occasional and frequent participation in team sports (50.5%) more common than individual (27.4%) and gym based workouts (26.4%). The majority (88.1%) of adolescents acknowledged the importance of diet and exercise for health.

Rigorous measurement of diet and physical activity behaviour and knowledge and attitude of health behaviour in this thesis was limited. Also, the sample used was not representative of adolescents in Kenya. The findings of this thesis are preliminary and further research is recommended using a representative sample and validated data collection methods. Research of this nature can be used in the adoption of school food and exercise policies to promote healthy behaviours and, on a national level, the development of dietary guidelines for adolescents.

Glossary of terms

Beverage — Any liquid other than water that can be consumed as a refreshment or nourishment.

Dietary behaviour — All observable actions of an individual related to food and, or drink consumption.

Drink — Any liquid that can be consumed as a refreshment or nourishment.

Energy dense foods and beverages— Foods and beverages with provide a high energy per unit weight owing to high sugar and, or fat content.

Fast foods - Convenience food purchased in self-service or take -out eating places such as fast food restaurants.

Food prepared away from home — Foods that are not prepared or processed within the home setting, usually purchased from establishments such as fast food outlets, school tuck shops and super-markets.

Mixed meals — According to the South African food-based guidelines for adults and children over the age of seven years, mixed meals are meals that comprise a variety of food groups such as starchy foods such as rice, pasta, potatoes or staple starches, which form the larger part of the meal, and are balanced by adding vegetables and a source of protein such as chicken, beef or soya. Mixed meals are usually consumed three times a day at breakfast, lunch and supper.

School provided meal — A meal offered to students in high school in the middle of a school day usually at lunchtime for a fee usually paid at the start of the school term by parents who want their children to partake in school provided meals.

School tuck shop — A small, food, snack and beverage-selling retailer within the school premises.

Abbreviations

ANGELO— ANalysis Grid for Environments Linked to Obesity

BMI— Body mass index

CDC — Center for Disease Control

CVDs — Cardiovascular diseases

EDB — Energy dense beverage

EDF — Energy dense food

GDP — Gross Domestic Product

HIV/AIDS — Human Immunodeficiency virus/Acquired Immune deficiency syndrome

KSh. — Kenya Shillings

LMICs —Low and middle-income countries

NCDs — Non-communicable diseases

SES — Socio-economic status

SSA — Sub Saharan Africa

T2D — Type 2 Diabetes

WHO — World Health Organization

Chapter 1: Introduction

1.1 Global burden of disease

Globally, the burden of disease due to non-communicable diseases (NCDs) has increased (Murray et al., 2012). In 2008, the majority of deaths that occurred worldwide were due to non-communicable diseases such as cardiovascular disease (CVD), cancers, respiratory diseases and diabetes (World Health Organization [WHO], 2011a). The rate of premature death due to NCDs is highest in low and middle-income countries (WHO, 2011a). In low and middle-income countries (LMICs), 44 percent of deaths due to NCDs occur in people before the age of 70, compared to 26 percent in high-income countries (WHO, 2011a). Furthermore, a higher proportion of NCD deaths among people below the age of 60, occur in LMICs (WHO, 2011a). Nevertheless, maternal, perinatal and nutritional conditions, and communicable diseases such as HIV/AIDS, malaria remain the significant health challenge in many LMICs (Murray et al., 2012). For example, HIV/AIDS is the leading health challenge in eastern and southern SSA while lower respiratory infections are the leading health challenge in South Asia, Andean Latin America and Oceania (Murray et al., 2012). Other significant communicable diseases in SSA are lower respiratory infections, malaria and diarrhoeal diseases (Murray et al., 2012). The WHO projects that in the African region, NCDs will exceed communicable diseases, maternal, perinatal and nutritional diseases as the most common causes of death in Africa by 2030 (WHO, 2011a). This projection is supported by the current shift in health risk factors in the region. Risk factors of communicable diseases such as childhood underweight, suboptimal breastfeeding and household air pollution from solid fuels are on the decline whereas risk factors for non-communicable diseases such as high blood pressure, high body mass index and high fasting plasma glucose are on the rise (Lim et al., 2012).

1.2 Non-communicable diseases in Sub-Saharan Africa

Non-communicable diseases have emerged as a health challenge in Sub-Saharan Africa (SSA) (Dalal et al., 2011; de-Graft Aikins et al., 2010). However, as noted above, infectious disease such as HIV/AIDS and malaria, and maternal and nutritional conditions continue to be the main health challenge in SSA and are the cause of most of the morbidity and mortality

in the region (Murray et al., 2012). According to the WHO, NCDs are projected to exceed infectious diseases as the most common causes of death in Africa by 2030 (WHO, 2011a). CVDs are the leading cause of NCD deaths globally (Lozano et al., 2012). The two leading CVDs in SSA are stroke and ischemic heart disease (Moran et al., 2013). The prevalence of NCDs varies significantly between and within the countries in SSA by gender and geographical location (Dalal et al., 2011). For example among individuals between the ages of 15 and 74, the prevalence of stroke ranges from 0.07 percent among females in urban Nigeria to 0.3 percent among females in rural South Africa, while the prevalence of type 2 diabetes varies from 0 percent in rural Togo to 10.8 percent in urban South Africa (Dalal et al., 2011).

In Kenya, as is the case in SSA countries other than South Africa, the magnitude of NCDs is not fully understood due to lack of reliable health data (Dalal et al., 2011), with this scarcity of NCD prevalence data possibly due to the historic focus on maternal and child health, and infectious diseases (Dalal et al., 2011). It is estimated that currently about 50 percent of all hospital deaths and 55 percent of all hospital admissions are due to NCDs in Kenya (WHO, 2012). In the last five years, the Kenyan Ministry of Health has developed policy documents for the control of various NCDs (“Kenya National Diabetes Strategy” and “National Cancer Control Strategy”), reflecting the growing threat of NCDs in the country. As the burden of NCDs in Kenya, as in other African countries, has been projected to rise (WHO, 2011a), it is necessary to identify the population groups at risk of NCDs as well as understand the drivers of the risk factors.

1.3 Conceptual frameworks

According to Miles & Huberman (1994, p. 18), “a conceptual framework is a visual or written product, one that explains, either graphically or in narrative form, the main things to be studied - the key factors, concepts, or variables - and the presumed relationships among them”. In other words, a conceptual framework refers to the concepts, assumptions, expectations, attitude, and theories that support and inform any research undertaking. The conceptual frameworks used in this thesis have been used to understand the development of NCDs and their risk factors, and include the life course perspective (Kuh, Shlomo, & Ezra, 2004) and ANalysis Grid for Environments Linked to Obesity (ANGELO) framework (Swinburn, Egger, & Raza, 1999). The ANGELO framework provides justification for the study setting. The life course perspective offers a framework within which to understand the development of NCDs, and supports the population group of focus in this thesis. Both of the

conceptual frameworks that are used in this thesis refined the research objectives and questions, and provided justification for the research undertaken.

1.3.1 Life course perspective

According to the life course perspective, exposure to either risk or protective factors across an individual's life course, across generations and on a population level determines health experiences and trends (Darnton-Hill, Nishida, & James, 2004). The life course approach has been used to understand the development of NCDs and has been defined by Ben-Shlomo & Kuh (2002) as “the study of long-term effects on chronic disease risk of physical and social exposure during gestation, childhood, adolescence and later in adult life. It includes studies of the biological, behavioural and social pathways that operate across an individual's life course, as well as across generations, to influence the development of chronic diseases”. Risk states of NCDs such as high blood pressure and high cholesterol, and risk factors of NCDs such as physical inactivity, unhealthy eating practices and overweight can persist from adolescence into adulthood (Darnton-Hill et al., 2004; Kuh et al., 2004). This thesis focuses on the physical inactivity and dietary risk factors of NCDs among adolescents. A recently conducted review found a positive correlation between the occurrence of various dietary and physical activity related behavior during adolescence and adulthood (Craigie, Lake, Kelly, Adamson, & Mathers, 2011). The consumption frequencies of fruits and vegetables, and energy dense items like soft drinks, sweets and chocolates remained the same among approximately 50 to 70 percent of the participants in a cohort of Norwegian adolescents between 15 - 21 years old (Lien, Lytle, & Klepp, 2001). Similarly, cross-sectional data from the Cardiovascular Risk in Young Finns Study showed that dietary patterns at the age of 15 years were maintained at the age of 36 (Mikkila, Rasanen, Raitakari, Pietinen, & Viikari, 2004). This trend was observed particularly among those who consumed diets very low in energy or high in energy. Physical activity-related behaviors such as participation in sports, day-to-day physical activities such as walking and cycling, and sedentary behavior in adolescence are maintained in adulthood (Craigie et al., 2011). The application of the life course approach in NCDs is useful due to the long latency period of these diseases (Kuh et al., 2004; Ben-Shlomo & Kuh, 2002).

In LMICs such as those in the Sub-Saharan African region, NCDs are reportedly on the rise (Dalal et al., 2011; de-Graft Aikins et al., 2010) but little is known about the population groups at risk (Dalal et al., 2011). Furthermore, due to a lack of longitudinal epidemiological

data in LMICs, it is not possible to understand the current incidence of NCDs from a life course perspective by tracing the current prevalence of NCDs to exposure to risk factors along the life course of affected population groups. Prevention and control strategies are the primary focus in NCD management (WHO, 2013a). In LMICs, these efforts are essential partly because these countries have fragile health systems that are under-resourced and in need of structural and policy reform, and therefore are not likely to meet the demand for NCD related health services (Samb et al., 2010). The life course approach provides a rationale for NCD risk monitoring among young population groups such as adolescents if LMICs are to contain the growing prevalence of NCDs.

1.3.2 ANalysis Grid for Environments Linked to Obesity (ANGELO) framework

Obesity is regarded as an important risk factor in the development of NCDs. In part, obesity is due to the consumption of more energy than is expended (Bouchard, 1991; Jèquier, 2002). In particular, the consumption of energy dense foods coupled with sedentary behaviours often promotes an energy imbalance and thus obesity. The ANGELO framework developed by Swinburn et al. (1999) recognises the role of environmental influences in the development of obesity. The four influential environments in the development of obesity are: physical, economic, political and socio-cultural environments. The physical environment refers to the “built” environment and includes all the opportunities to consume food and to engage in physical activity. The “built” environment is a reflection of the political, economic and socio-cultural environments. According to the ANGELO framework, within the physical environment, individuals occupy and interact with various micro-environments such as schools, offices and supermarkets (Swinburn et al., 1999).

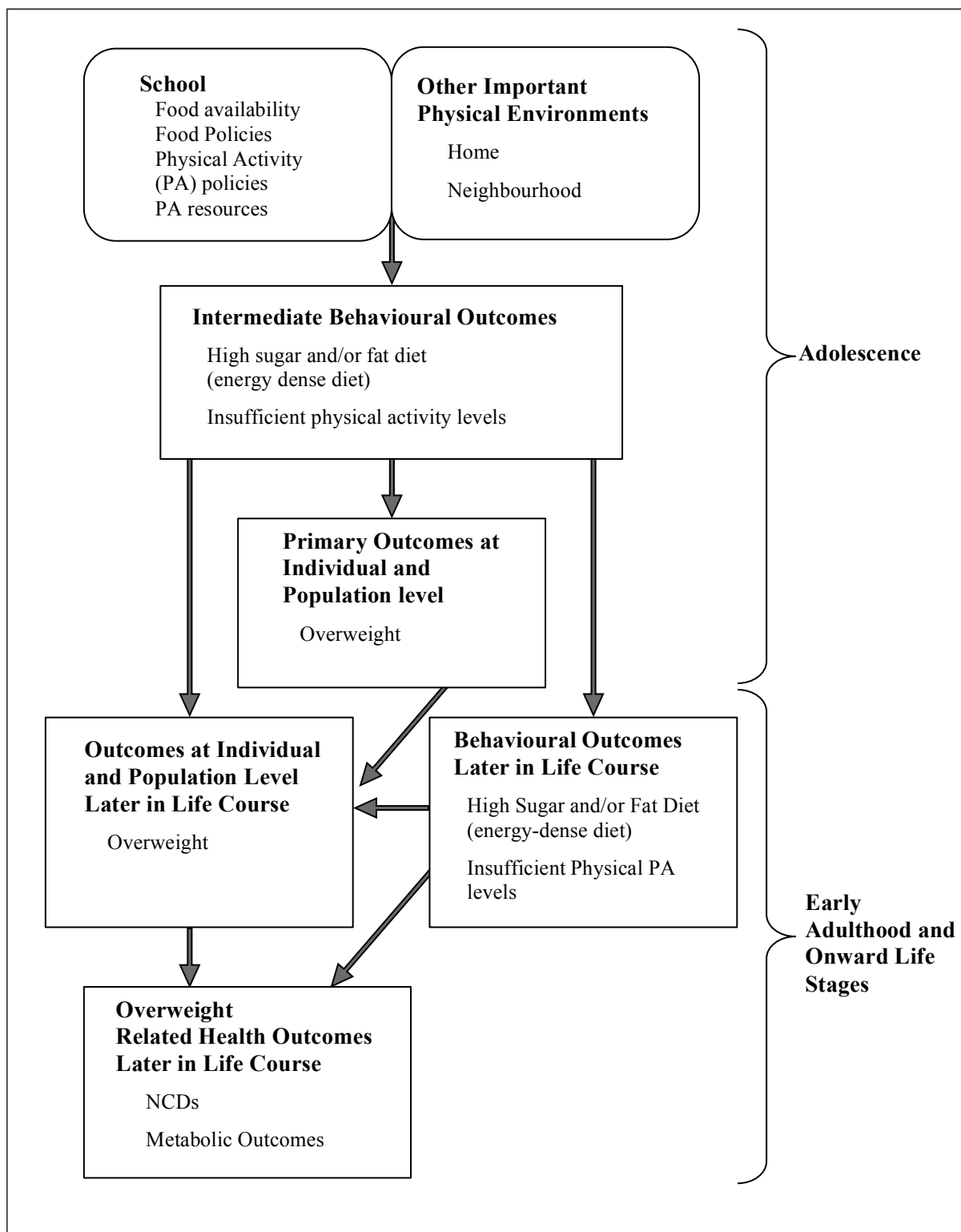
Although this framework was developed approximately two decades ago to understand the development of overweight and obesity in high-income countries, with the prevalence of overweight and obesity on the rise in LMICs (Dalal et al., 2011; de-Graft Aikins et al., 2010), its application is increasingly relevant today in many LMICs. In addition, LMICs, such as those in Africa, have undergone a nutrition transition, that is a shift in dietary patterns and physical activity behaviour, which is largely attributed to a change in their political, social, physical and economic environments (Lakdawalla & Philipson, 2009; Popkin, 2001). Increasingly LMICs and high-income countries have some similarities in terms of the opportunities for and barriers to dietary intake and physical activity exertion that they present.

The prevalence of obesity and overweight in LMICs however remains lower than that of high income countries. Therefore, in LMICs the ANGELO framework provides basis for understanding and mitigating the growth of overweight and obesity.

1.3.3 Application of the conceptual frameworks

The application of the ANGELO framework and the life course perspective in this thesis is illustrated in Figure 1.1 below. This thesis investigates the consumption of dietary items that are high in sugar and fat, and the frequency of physical activity among adolescents. These are referred to as intermediate behavioural outcomes in Figure 1.1. As students spend a significant amount of time at school, the dietary and physical activity patterns in the school environment are therefore important (Pate et al., 2012). Based on the ANGELO framework (Swinburn et al., 1999), this thesis hypothesises that the dietary and physical activity behaviour of adolescents in the school setting might partly reflect the school food and physical activity environment, and the wider school food and physical activity policies. The life course approach provides a rationale for the focus of this thesis on adolescents. Unhealthy dietary behaviour such as high consumption of sugar and fats, and low physical activity levels can persist into adulthood (Craigie et al., 2011). Overweight and obesity developed during adolescence can persist into adulthood (Darnton-Hill et al., 2004; Kuh et al., 2004), and lead to an increased risk of NCDs (Kuh et al., 2004; Lobstein et al., 2004). The application of the ANGELO framework and life course perspective is limited to the investigation of selected dietary and physical activity behaviour of adolescents.

Figure 1.1: Schematic overview of conceptual framework of this thesis



1.4 Kenya: A country context for studying risk factors of NCDs

Kenya is an African country located in the Eastern Sub-Saharan Africa region. Kenya is classified by the World Bank as a low-income country with a per-capita income of approximately 820 US Dollars (Randa & Gubbins, 2013). According to the available estimates, in October, 2009, households in Kenya with a monthly expenditure less than 23,670 Kenyan Shillings (KSh.) were classified as low income, households with a monthly expenditure between KSh. 23,671 and 119,999 as middle-income, and households with a monthly expenditure above KSh. 121,000 as high-income (Kenya National Bureau of statistics [KNBS], 2013). Kenya's economy is driven predominantly by agricultural activities (KNBS, 2013), however the service sectors such as finance, real estate, communication and tourism contribute significantly to Kenya's GDP. Nairobi, Kenya's capital city, is the hub of the country's service sector. Nairobi also acts as the economic hub for the East and Central Africa region. According to the 2009 nationwide census, the population size of Kenya was estimated to be 38.6 million (KNBS, 2013). The age structure of the Kenyan population is typical of a low-income country, with more people in the younger age groups than in the older age groups. Forty-three percent of the total population is under the age of 15 years, and 62 percent of the total population is under the age of 25 (Population Reference Bureau [PRB], 2011). According to UN HABITAT, in 2001, 34 percent of the Kenyan population resided in urban areas. Recent estimates indicate that eight percent of the country's population resides in Nairobi, the capital city of the Kenya (KNBS, 2013) and 30 percent of its inhabitants are under the age of 15 years (PRB, 2011).

Communicable diseases are the main health challenge in Kenya (WHO, 2013b). However, according to data from the Institute for Health Metric and Evaluation (IHME), the total burden from some of the communicable diseases in Kenya has decreased between 1999 and 2010 (IHME, 2013). For example, the burden of disease from malaria decreased from 14 percent in 1990 to nine percent in 2010, and that from diarrhoeal and lower respiratory infections from 33 percent in 1999 to 21 percent in 2010 (IHME, 2013). However the burden of disease due to HIV/AIDS and tuberculosis combined has increased between 1999 and 2010 from six percent to 22 percent (IHME, 2013). In contrast to communicable diseases, NCDs account for a smaller burden of disease in Kenya. As previously noted, estimates from WHO indicate that in 2004, NCDs account for 20.3 of the burden of disease in Kenya (WHO, 2013b). While the exact prevalence data is not available, the WHO (2012) has reported that the burden of disease from NCDs has increased in Kenya. These trends in burden of diseases

due to communicable diseases and NCDs are supported by the current shift in health risk factors in LMIC. Specifically, the risk factors of communicable diseases are on the decline whereas risk factors for non-communicable diseases such as high blood pressure and high body mass index are on the rise (Lim et al., 2012). The prevalence of obesity and overweight, both risk factors of NCDs, has been estimated among selected adult population groups (Ziraba, Fotso, & Ochako, 2009) and non-adult population groups (Abdulkadir, Sohani, & Agoi; Gewa, 2010; Semproli & Gualdi-Russo, 2007; Marinda, 2006) in Kenya. However, little is known about the causes of overweight and obesity among these population groups. In Nairobi, the environmental changes such as the diversification of the fast food industry and rapid urbanization (Dixon et al., 2007) are likely to increase the risk of overweight and obesity.

As noted above NCDs are a growing health problem in Kenya (WHO, 2013b). Because NCDs develop over a long period of time (Kuh et al., 2004; Ben-Shlomo & Kuh, 2002), the early identification and monitoring of population groups at risk is possible. Presently, the Kenyan policy initiatives to control NCDs do not consider risk of NCDs among younger population groups such as adolescents. This thesis is supported by the life course perspective, which provides the framework for the investigation of risk of NCDs among adolescents, some of whom may bear the harbingers of NCDs (Kuh et al., 2004). It is also supported by the ANGELO framework, which provides a system for understanding how environmental influences might be influential in the adoption of unhealthy diets and physical inactivity. This thesis investigates selected dietary and physical activity behaviours among adolescents likely to be from households above the middle-income threshold in Nairobi, Kenya.

1.5 Research significance and objectives

The burden of NCDs has increased in Kenya, and is projected to rise further (WHO, 2011b). The food environment in urban Kenya has changed to include the consumption of energy dense dietary items such as fast foods and sugar sweetened beverages¹ (Dixon et al., 2007).

¹ Sugar sweetened beverages are any sugar-sweetened or artificially sweetened fruit-flavoured drinks, sports (natural or artificial) drinks, and drinks that contain 100% fruit juice;

There may be a link between the changing lifestyles in Kenya and the increase in NCDs. According to the life course perspective, many of the risk factors of NCDs develop early in life and later contribute to NCD related morbidity and mortality in adulthood (Kuh et al., 2004; Ben-Shlomo & Kuh, 2002). According to the ANGELO framework the dietary and physical activity behaviour of individuals depends on the available opportunities to consume food, and engage in physical activity (Swinburn et al., 1999).

1.5.1 Research aim and objectives

The aim of the cross-sectional survey was to investigate selected dietary and physical inactivity behaviours, identified in Figure 1.1 in section 1.3.3 as intermediate behavioural outcomes, among a sample of adolescents in Nairobi, Kenya.

The research objectives were as follows:

- To assess the consumption of energy dense foods and beverages, including the sources of these foods on a single school day;
- To determine weekly consumption frequency of selected energy dense dietary items;
- To determine weekly participation in selected sport activities while at school;
- To determine body weight status; and
- To establish attitude regarding the importance of diet and physical activity for health.

1.5.2 Research questions

Among a sample of adolescents likely to be from households above the middle-income threshold in Nairobi, this research aimed to answer the following questions:

carbonated sodas that include sugar or artificial sweetener, caffeinated or decaffeinated; and sugar-sweetened or artificially sweetened, caffeinated or decaffeinated tea or coffee

- Do the adolescents consume energy dense dietary foods and beverages during a single school day?
- What is the weekly consumption frequency of selected energy dense dietary items?
- What is the weekly frequency of participation in selected physical activities?
- What is the participants' attitude regarding the importance of diet and physical exercise for health?
- What is the distribution of body weight?

1.6 Outline of the thesis

This thesis consists of five chapters. Chapter 1 provides background information relevant to this research study and establishes an understanding as to why this research was undertaken. The chapter also provides the theoretical framework used in this research and the specific research objectives and questions. Chapter 2 presents a review of the literature encompassing the risk factors of overweight in Sub-Saharan Africa with a focus on adolescents. The details of the research methodology including the ethical considerations are provided in Chapter 3. The results of the study are presented in Chapter 4. Chapter 5 provides a discussion of the major findings, the implications and recommendations for future research.

Chapter 2: Risk of overweight and obesity among adolescents

2.1 Overview

As discussed in the previous chapter, non-communicable diseases are on the rise in developing middle- and low-income countries (Dalal et al., 2011; de-Graft Aikins et al., 2010), a trend attributed partly to a rise in overweight and obesity (Lim et al., 2012) and to changing patterns in various determinants of risk and mitigating factors. While this thesis focuses on the rise of NCDs in Kenya, a Sub-Saharan African country, due to the absence of literature specific to this country, this review relies on the wider international literature, and where available, literature from SSA. Research from other Sub-Saharan countries is highly relevant to Kenya with whom they share comparable disease patterns, risk factors and social, economic and environmental determinants of health. The first part of the review (Section 2.2) provides an overview of body weight status as risk factor of NCDs, its measurement, and the determinants of obesity and overweight, including the characteristics of an “obesogenic” environment. The next part of the review (Section 2.3) is an overview of overweight and obesity in SSA, including determinants more specific to that region, which are also relevant for Kenya. Section 2.4 specifically reviews the research on adolescence and body-weight, in relation to the school environment and in terms of dietary and physical activity behaviour among adolescents in SSA. The conclusion (Section 2.5) provides an overall synthesis, which demonstrates the significance of this research in addressing gaps in the Kenyan literature on adolescent behaviour relevant to overweight and obesity.

2.2 Body weight status as a risk factor of non-communicable disease

Body fat is often used to define body weight status. Body weight status that is characterised by an excessive accumulation of body fat has been associated with increased risk of NCDs such as hypertension and type 2 diabetes (WHO, 2013c). The WHO attributes excessive accumulation of body fat to 44 percent of the burden of disease due to diabetes, 23 percent due of the burden of disease due to ischaemic heart disease, and between 7 and 41 percent of the burden of disease due to certain cancers among other NCDs (WHO, 2013c). The findings from prospective studies such as the Bologusa Heart Study (O’Neil et al., 2012) and the Framingham Heart Study (Fox, 2010) have demonstrated that among adult populations in developed countries the risk of NCDs is higher among overweight and obese individuals.

Global estimates indicate that there is an increase in the prevalence of both overweight and obesity in both developed and developing countries (Caballero, 2007; Kurukulasuriya & Sowers, 2007). Nevertheless, the prevalence of obesity and overweight is higher in developed countries such as those in Europe and North America than in African countries, which are less developed (Lobstein, Baur, & Uauy, 2004). That said, the prevalence of excessive accumulation of body fat is reportedly on the rise in Africa (Ziraba et al., 2009) and Asia (Yoon et al., 2006).

2.2.1 Assessment of body weight status

Body fat content is used in the assessment of body weight status. Techniques such as dual-energy X-ray absorptiometry and magnetic resonance imaging are highly accurate and direct methods of measuring body fat content, however these techniques are too costly for use in routine clinical practice and epidemiological studies (Freedman & Sherry, 2009). For practical reasons, Body Mass Index (BMI), which is a measure of weight in relation to height, and has a high correlation with excessive body fat content (Hubbard, 2000) is used in research and clinical settings (Freedman & Sherry, 2009; Hubbard, 2000). In addition, the WHO recommends the use of BMI for the identification of overweight and obese individuals at the population level (WHO, 2013c). However, it is important to note that BMI values may not correspond to the same degree of body fat in different population groups, in part due to different body proportions (Hubbard, 2000; WHO, 2006).

Among adults, BMI is defined as weight in kilograms divided by the square of height in metres (kg/m^2) (WHO, 2013c). As is shown in Table 2.1, adults are classified according to the index as follows: a BMI less than 18.5 kg/m^2 is underweight; equal to 18.5 kg/m^2 or less than 25 kg/m^2 is of a healthy weight; equal to 25 kg/m^2 , or less than 30 kg/m^2 is overweight; and a BMI equal to or greater than 30 is obese (WHO, 2013c). Because the amount of body fat differs with age and gender among children and adolescents (Freedman & Sherry, 2009), BMI is applied differently from adults. Among children and adolescents, BMI values are plotted on a graph that takes into account each month of age and gender in order to obtain a percentile ranking (Reilly, 2006). Children and adolescents between 5 and 19 years are classified according to the age and gender specific BMI percentiles as follows: a BMI below the 5th percentile is underweight, a BMI between the 5th percentile up to the 85th percentile is healthy weight, a BMI between the 85th percentile but below the 95th percentile are defined as

overweight; a BMI equal to, or greater than the 95th percentile is defined as obese (WHO, 2007). As is shown in Table 2.2, the Center for Disease Control (CDC) uses different BMI cut-offs to classify children aged 2 -18 years (Kuczmarski, Ogden, & Guo, 2000). The main difference in the CDC classification from the WHO classification is the inclusion of ‘risk of overweight’ body weight status.

Table 2.1: *WHO classification of adults and children using BMI*

WHO Classification	Adults	Children, aged 2-18 years (based on age and gender specific BMI percentiles)
Underweight	less than 18.5 kg/m ²	Less than the 5 th percentile
Healthy weight	18.5 to 24.9 kg/m ²	5 th percentile to less than the 85 th percentile
Overweight	25 to 29.9 kg/m ²	85 th percentile to less than the 95 th percentile
Obese	30 kg/m ² and above	95 th percentile and above

Table 2.2: *CDC classification of children aged 2-18 years using BMI*

CDC Classification	Children, aged 2-18 years (based on age and gender specific CDC BMI percentiles)
Underweight	Less than the 5 th percentile
Healthy weight	5 th percentile to less than the 85 th percentile
Risk of overweight	85 th percentile to less than 95 th percentile
Overweight	95 th percentile to less than the 97 th percentile
Obese	97 th percentile and above

2.2.2 Determinants of overweight

The aetiology of overweight is complex and includes genetic, environmental and psychosocial factors (Bouchard, 1991; Jèquier, 2002). However, the recent increase in the prevalence of overweight has been attributed to mostly behavioural factors influenced by environmental changes, rather than changes in genetic make-up (Jèquier, 2002; Spiegelman & Flier, 2001). Behavioural risk factors that promote weight gain are tobacco use (Audrain-McGovern & Benowitz, 2011), unhealthy diets (Pearson & Biddle, 2011), insufficient physical activity (Pearson & Biddle, 2011) and the harmful use of alcohol (Sayon-Orea, Martinez-Gonzalez, & Bes-Rastrollo, 2011). The scope of this thesis is limited to the role of diet and physical inactivity in the development of obesity and overweight. Diet contributes towards energy intake and physical activity towards energy expenditure with both obesity and overweight regarded as the result of an energy imbalance between energy intake and expenditure (Bouchard, 1991).

The role of diet in weight gain has been widely investigated, and many of these studies have focused on dietary patterns rather than on dietary nutrients (Hu, 2002). Dietary pattern analysis studies have used factor analysis to identify two major dietary patterns: “Western” dietary pattern and “prudent” dietary pattern (Malik et al., 2012). The “prudent” dietary pattern is characterized by a high consumption of vegetables, fruit, legumes, fish, and low consumption of snacks high in fat and, or sugar (termed energy dense snacks henceforth) and soda. In contrast, the “Western” dietary pattern is characterized by a high consumption of desserts, energy dense snacks, processed meats, red meat, French fries, and refined grains and low consumption of vegetables, fruit, and fish. The findings of a systematic review of the literature from cross-sectional and prospective studies of dietary patterns and health outcomes such as overweight and various NCDs suggest that dietary patterns can be used as a predictor of health outcomes (Kant, 2004). The review found that dietary patterns, in which fat contributed a lower percentage of total energy intake, were associated with better health outcomes (Kant, 2004). A healthy body weight is associated with dietary patterns low in fat such as those characterised by the high consumption of high fiber foods such as whole grains, legumes, fruits, and vegetables (Hu, 2002) and high consumption of dairy products (Louie et al., 2011). In contrast, the “Western” dietary pattern, which is high in sugar and fat, is associated with increased risk of weight gain (Hu, 2002).

Weight gain has been linked to the high consumption of fast foods (Pearson & Biddle, 2011) and sugar-sweetened beverages (Hu & Malik, 2010; Olsen & Heitmann, 2009) owing to their energy density (Prentice & Jebb, 2003) and low satiety property (Hu & Malik, 2010; Jèquier, 2002). The low satiety property of these dietary items promotes their over consumption (Hu & Malik, 2010; Jèquier, 2002). Fast foods, energy dense snacks and sugar-sweetened beverages are energy dense (Prentice & Jebb, 2003) because they are high in fat, and or sugar (Hu & Malik, 2010; St-Onge, Keller, & Heymsfield, 2003). Research suggests that fast food consumption is associated with the increased intake of sugar-sweetened beverages and lower intakes of fruits, vegetables, fibre and milk across all age groups (Bauer et al., 2004; Bowman et al., 2004; Bowman & Vinyard, 2004; St-Onge et al., 2003). This association might be related to the increased reliance on fast food outlets. However, the evidence of the role of fast foods and sugar-sweetened beverages in the development of obesity is mixed (Nelson & Lytle, 2009). Nevertheless, the recent increase in the prevalence of overweight has been accompanied by an increase in the consumption of food prepared away from home such as fast foods and sugar-sweetened beverages (St-Onge et al., 2003). Therefore, even though a

causal relationship cannot be implied, these dietary items are high in fat and, or sugar (Hu & Malik, 2010; St-Onge et al., 2003) , therefore according to WHO (2004), their consumption should be discretionary in order to maintain a health body weight.

Physical activity contributes to the other side of the weight gain energy imbalance (Spiegelman & Flier, 2001). The WHO has age specific recommendations regarding the frequency, duration, intensity, type and total amount of physical activity needed for good health including the maintenance of a healthy weight. Children and adolescents aged 5-17 years should engage in at least 60 minutes of aerobic activities at a moderate intensity daily (WHO, 2011c). Adults aged 18 years and above should engage in at least 150 minutes of aerobic physical activity at a moderate intensity each week, or at least 75 minutes of aerobic physical activity at a vigorous intensity (WHO, 2011d; WHO, 2011e). Additional time spent engaging in aerobic physical activity at moderate to vigorous intensity results in additional health benefits to individuals across all the age groups (WHO, 2011c; WHO, 2011d; WHO 2011e). Current research suggests that physical activity across all age groups is low (Tremblay et al., 2011). The current evidence indicates that physical inactivity is associated with the overweight (te Velde et al., 2012).

2.2.3 “Obesogenic” physical environments and overweight/obesity

As previously noted, environmental influences have a significant effect on diet and physical activity, and thus on the risk of obesity and overweight (Swinburn et al., 1999). Physical environments refers to as “built” environments by (Swinburn et al., 1999) such as schools, workplace and home provide opportunities to eat and purchase food and opportunities for physical activity within them. In this way the “built” environment influences energy balance. A “built” environment that promotes a high energy intake and low energy expenditure is regarded as “obesogenic”, (Swinburn et al., 1999). Swinburn et al. (1999) define “obesogenicity” of an environment as “the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations”. For instance a built environment with local fast food outlets, has been linked to increased consumption of energy dense items such as fast foods and sugar-sweetened beverages (Li, Harmer, Cardinal, Bosworth, & Johnson-Shelton, 2009), and is thus obesogenic. Generally, food from restaurants is higher in fat and energy than food prepared within the home environment (French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001; Popkin, Duffey,

& Gordo-Larsen, 2005). Restaurants and other convenience food sources such as supermarkets, tuck shops and vending machines have been associated with the high consumption of energy dense foods and beverages such as French fries, cheeseburgers and sugar added carbonated drinks (French et al., 2001). “Obesogenic” environments undermine the consumption of healthy options such as vegetables and fruits (Popkin, Duffey, & Gordo-Larsen, 2005).

“Obesogenic” environments offer limited opportunities for energy expenditure through physical activity. Urban sprawl, limited open spaces and recreational facilities, and reduced opportunities to cycle or walk as a medium of transportation are characteristics of “obesogenic” physical environments as they reduce opportunities for physical exertion (Feng et al., 2010). Similarly, “obesogenic” environments promote sedentary lifestyles characterised by increased television watching and screen time among other sedentary behaviours. Other aspects of “obesogenic” environments include reduced opportunities for physical activity due to increased importance of better paying office jobs, or school curriculum activities in place of sports activities. The ANGELO framework provides an opportunity to assess factors in the physical environment likely to promote weight gain. Changes to the “built” environment such as increased cycling lanes and more opportunities to purchase healthy foods such as vegetables can have long-term effects on the dietary and physical activity behaviours of individuals and thus ensure healthy weight.

2.3 Obesity and overweight in Sub-Saharan Africa

In recent years the prevalence of obesity has increased worldwide, including in developing countries (Misra & Khurana, 2008). The prevalence of obesity and overweight in the Africa region is low compared to other WHO regions (Lobstein et al., 2004). In Africa under-nutrition particularly among children remains high (Lim et al., 2012). The lack of nationally representative cross-sectional and longitudinal data in SSA is an obstacle in understanding the magnitude and development of obesity and overweight in the region. Apart from South Africa, most of the other countries in SSA lack reliable health data on the prevalence of obesity and overweight (Adeboye, Bermano, & Rolland, 2012; Dalal et al., 2011). A recent systematic review of surveys, case-control and cohort studies conducted in various African countries to examine the prevalence of BMI value of 28kg/m^2 and more, and their associated co-morbidities among individuals aged 17 years and above, found that there were marked variations in the prevalence of overweight between African countries (Adeboye et al., 2012).

These variations are probably due to differences in stages of environmental changes in each of the countries (Ekpenyong & Apkan, 2013). Variations in the prevalence of overweight within African countries includes gender differences (Adeboye et al., 2012; Cappuccio et al., 2008; Tuei, Maiyoh, & Ha, 2010; Ziraba et al., 2009), variations by geographical location (Adeboye et al., 2012; Dalal et al., 2011), and disparities by socio-economic status (SES) (Tuei et al., 2010). Urban residency (Adeboye et al., 2012; Dalal et al., 2011) and a high SES (Tuei et al., 2010) are associated with a higher prevalence of overweight. Regarding SES, it is important to note that survey data from Kenya, Burkina Faso, Ghana, Malawi, Niger, Tanzania and Senegal, indicate that the prevalence of overweight has risen by about five percent between the years surveyed mostly among women in the lowest socio-economic class between the years the survey was conducted (Ziraba et al., 2009). Therefore, it would seem that there is less of a SES gradient in the prevalence of overweight in SSA and this might be related to unhealthy dietary practices such as the high consumption of street foods (Bhat, 2000; van t' Riet et al., 2001). As there is a growing prevalence of overweight in SSA countries as in other developing countries (Misra & Khurana, 2008), it is important that countries in SSA identify the determinants of overweight.

2.3.1 Environmental determinants of overweight in Sub-Saharan Africa.

Environmental changes in SSA have been attributed to globalization, infrastructural advancement, urbanization and economic development (Lakdawalla & Philipson, 2009; Popkin, 2001). Changes in the socio-economic, cultural and political environment have enabled foreign investors to penetrate the foods industry and the markets in developing countries (Popkin, 1998), and in the process influenced the food environment particularly in SSA. For instance, international fast food outlets are common in cities in SSA (Kearney, 2010). Also processed products such as cheap vegetable oils and fats (Drewnowski & Popkin, 1997) are increasingly available in SSA. Transnational food corporations have been linked to increased availability of highly processed foods that are rich in fats and sugar thus energy dense (Tuei et al., 2010). Most of the dietary changes related to the “built” environment are concentrated in urban SSA (Drewnowski & Popkin, 1997; Misra & Khurana, 2008). Regarding energy expenditure, urbanisation, globalisation and technological advancements have reduced opportunities for physical activity, leading increasingly to sedentary lifestyles (Adeboye et al., 2012; Popkin, 1998). For example, reduced open spaces (Lee, Ewing, & Sesso, 2009) and office jobs (Philipson & Posner, 2008), and sedentary behaviours such as

television watching are promoting of sedentary lifestyles. Therefore it is likely that the “built” environment in urban SSA is “obesogenic”.

Other environmental changes that have occurred in SSA are in the economic environment (Tuei et al., 2010). In SSA, the high consumption of processed foods among affluent individuals may be due to higher disposable income (Popkin, 1998; Tuei et al., 2010). Finally, changes in cultural perceptions that associate being overweight with beauty, health and wealth have promoted the development of overweight (Misra & Khurana, 2008). Perceptions surrounding HIV/AIDS have promoted an “obesogenic” socio-cultural environment, as weight loss is associated with HIV/AIDS.

2.4 Adolescence and body weight

Adolescence is a transitional development stage between childhood and adulthood that is characterized by physical and physiological changes (DiClemente, Santelli, & Crosby, 2009, p.4). Body weight changes occurring during adolescence are in part due to the physiological changes associated with adolescence (Shepherd & Denninson, 1996). Body weight status is also influenced by the development of attitude and perceptions especially among girls, regarding their rapidly changing physiques and increased awareness of body shape (DiClemente et al., 2009, p.9). For example, thinness is often desirable and might lead to restrained consumption among adolescent girls (Shepherd & Denninson, 1996). Also, as a result of increased autonomy, adolescents might engage in unhealthy dietary practices that promote weight gain such as eating more often, in restaurants (Shepherd & Denninson, 1996), and engaging in sedentary behaviour (DiClemente et al., 2009, p.4).

2.4.1 Adolescent obesity and overweight and the role of the school environment

It is estimated that worldwide, there are about 155 million overweight and obese children and adolescents, of whom approximately 30 to 45 percent are obese (Lobstein et al., 2004; Wang & Lobstein, 2006). The prevalence of overweight among adolescents has increased over the past two decades (Raj & Kumar, 2010). Overweight is linked to an increased risk of NCDs during adolescence and in adulthood (Lobstein et al., 2004). Adolescent obesity is a public health problem in both developed and developing countries (Raj & Kumar, 2010). In SSA, the prevalence of obesity and overweight among adolescents is on the rise (Misra & Khurana 2008). However, in comparison to other regions worldwide, the prevalence of obesity and overweight among children in SSA remains low (Lobstein et al., 2004).

The “built” environment, as defined in the ANGELO framework, contributes significantly to increased risk of overweight among adolescents by heavily targeting adolescents through marketing strategies that promote the consumption of energy dense dietary items. In addition to the high consumption of energy dense dietary items, low physical activity and sedentary lifestyles are important mediators of overweight among adolescents (Jèquier, 2002; Nguyen & El-Serag, 2010; Spiegelman & Flier, 2001). Other dietary behaviours such as low meal frequency and meal skipping, eating while watching TV, large portion sizes and the consumption of energy dense snacks, sugar added beverages, and food prepared away from home such as from fast food restaurants and school canteens have been widely investigated, particularly in developed countries (Agostini et al., 2011). These behaviours are influenced by environmental characteristics such as the nature of the food supply and food advertising, marketing, prices and promotion (St-Onge et al. 2003). The “built” environment increasingly offers cheap energy dense dietary items, and this has driven their consumption in developed countries (St-Onge et al. 2003) and urban settings in developing countries (Schmidhuber & Shetty, 2005). Longitudinal data from developed countries suggests that the increase in consumption of energy dense dietary items has coincided with the increase in prevalence of overweight and obesity among adolescents (St-Onge et al. 2003). The prospective evidence for the role of energy dense dietary items such as sugar sweetened beverages, fast foods and energy dense snacks in adolescent obesity and overweight is mixed (Pate et al., 2013), although it is believed that these play a part in mediating weight gain (Agostini et al., 2011; Malik et al, 2010; Prentice & Jebb, 2003). Similarly, sedentary behaviours have been implicated in adolescent obesity (Pearson & Biddle, 2011), but the prospective evidence is limited and mixed (Pate et al., 2013).

One of the “built” environments with significant influence on the diet and physical activity patterns of school going adolescents is the school setting (Kubik, Lytle, Hannan, Perry, & Story, 2003; Bell & Swinburn, 2002). As students spend a significant amount of time at school, the dietary and physical activity patterns in the school environment are important (Pate et al., 2012). Environmental factors in a school setting such as the availability of vending machines, tuck shops and cafeterias influence the consumption of energy dense foods and beverages (Kubik et al., 2003; van der Horst et al., 2008; Wildey et al., 2000). According to the ANGELO framework, these environmental factors make school environments “obesogenic”. A study conducted among adolescents attending various high schools in Australia found that energy dense foods and beverages contribute significantly to the total

energy intake of students while at school (Bell & Swinburn, 2004). Similar findings have been reported among high school students in the United States of America (Briefel et al., 2009).

The second aspect of “built” environment relates to the available opportunities for physical activity. Schools provide these opportunities through physical education programmes and extra-curricular sport (Woods et al., 2010). However, reductions in the time allocated for free play and extracurricular sport and students’ preference for sedentary behaviours (Woods et al., 2010) prevent adolescents from engaging in physical activity as is recommended. The WHO recommends that children and adolescents aged 5 to 17 years should engage in at least 60 minutes of aerobic activities at a moderate intensity daily (WHO, 2011a). Therefore, whereas there is limited prospective research on the association between adolescent obesity, and the school food and physical activity environments (Pate et al., 2012), the school environment appears to be crucial in the development of adolescent obesity and overweight

Besides the likelihood of an “obesogenic” school environment, this setting offers a convenient setting for health promotion interventions among school going adolescents (Brug et al. 2010). The WHO developed the Global Strategy on Diet and Physical Activity (DPAS) School Policy Framework in response to the growing burden of NCDs in LMICs. It was developed to help LMICs to design and implement school policies and programmes that promote healthy eating and increase the levels of physical activity (WHO, 2008). School related policies such as limiting the operating hours of school stores and regulating the food and beverages available from school store and vending machines are successful in promoting healthy eating practices among adolescents (Jamie & Lock, 2009; Neumark-Sztainer et al., 2005).

2.4.2 Dietary and physical activity behaviours among adolescents in Sub-Saharan Africa

There are a few studies that have been conducted in SSA to understand the dietary behavior of adolescents in the school environment, even though the food environment in general has changed to include an increase in the consumption of foods that are high in sugar and fat, and low in fibre, and increasingly sedentary lifestyles (Drewnowski & Popkin, 1997; Misra & Khurana, 2008). Furthermore, whereas low levels of physical activity has been associated with unhealthy dietary behavior (Pearson & Biddle, 2011), there are few studies that investigate both the dietary and physical activity behaviour of adolescents in SSA. Relevant

literature was searched using MEDLINE and EMBASE (see appendix A). Additionally, citations were searched for relevant literature. Due to the scarcity of research relevant to this thesis, studies conducted outside the school environment are included in the literature review.

The review of the literature on the physical activity among adolescents in this thesis was limited to studies that investigated both physical activity and dietary behaviour, and also to studies that used a questionnaire to investigate physical activity levels. Two studies were retrieved that investigated both dietary and physical activity behaviours of adolescents in SSA are summarized in Table 2.3. Doku et al. (2013) investigated the levels of physical activity among adolescents in Ghana using a four point Likert-type scale whose responses were split into two categories: physically active and not physically active. They found that 69 percent of adolescents in Ghana were physically active, and that boys were more likely to report that they were physically active than girls. In Ghana and Uganda, Peltzer & Pengpid (2011) investigated physical activity among adolescents which they defined as any activity that increases heart rate and makes one get out of breath such as running, fast walking, biking and dancing apart from physical education and gym based workouts. They found that 78.5 percent of males and 84.9 percent of females studied engaged in less than 60 minutes of physical activity in up to five days each week. Doku et al. (2013) and Peltzer & Pengpid (2011) found that fruit and vegetable consumption was low among the adolescents studied.

Table 2.4 below is a summary of the six studies that investigated the dietary behaviour of adolescents between 12-19 years in SSA. The studies used various designs and methods to investigate dietary behaviour: one 24-hour dietary recall (Maruapula et al., 2011), two 24-hour dietary recalls (Nago et al., 2010), a non-quantified weekly Food Frequency Questionnaire (FFQ) (Adesina, Peterside, Anochie, & Akani, 2012; Dapi et al., 2005) and a quantified weekly FFQ were used in the studies (Feeley, Musenge, Pettifor, & Norris, 2012). Temple, Steyn, Myburgh, & Nel (2006) investigated two diet-related behaviours; the food and beverage purchases made by students while at school, and breakfast consumption. Temple et al. (2006) also investigated dietary knowledge among adolescents, that is their knowledge of “healthy” and “unhealthy” foods. Feeley et al. (2012) investigated the foods students brought from home to school. The studies in Table 2.4 made use of various proxy measures of SES such as school of attendance, that is tuition-requiring private schools, or tuition-free or low-cost public schools (Temple et al., 2006); possession of household assets such as a television and a refrigerator (Feeley et al., 2012); and parental occupation and education status (Adesina

et al., 2012). These studies demonstrated that high SES is associated with frequent consumption of energy dense foods and beverages, and food from restaurants, especially among adolescents in urban settings. These findings corroborate the ideas of Drewnowski & Popkin (1997) and Misra & Khurana (2008) who suggest that the lifestyle in most developing countries especially in urban settings increasingly includes the consumption of foods that are high in sugar and fat, and low in fibre. This might be related to a higher concentration of environmental changes in urban settings in developing countries (Popkin, 1998). The study design in the survey conducted by Maruapula et al. (2011) and Dapi et al. (2005) allowed for the comparison of dietary behaviour of adolescents in urban and rural settings.

Of the eight studies summarised in Table 2.3 and Table 2.4, five reported on the body weight status of the adolescents. However, only two dietary studies analysed the association between body weight status and the dietary intake behaviours investigated. These two studies used varied study designs and therefore any comparison is limited. Adolescents in the study by Maruapula et al. (2011) reported the number of servings of specific foods they ate on a previous day. The researchers found that the number of servings of the various foods was not significantly different across body weight status groups. However, they also found that overweight adolescents consumed more servings of vegetables ($p = 0.012$) and savoury energy dense snacks ($p < 0.001$) than healthy weight adolescents. In the study by Nago et al. (2010), body weight status did not differ between the low and high consumers of convenience foods. However, this finding may have been related to the similar total energy intake between low and high consumers of convenience foods (Nago et al., 2010).

In general, the studies in Table 2.3 and Table 2.4 focus on dietary and physical activity behaviours among the adolescent population rather than on associating body weight status and dietary and physical activity behaviour. This might be related to the general complexity and high cost of objectively assessing dietary behaviour (Barrett-Connor, 1991) and physical activity behaviour (Warren et al., 2010). The complexity and cost of physical activity studies and dietary studies might also explain the study designs adopted in the studies summarized in Table 2.3 and Table 2.4. Nevertheless, the studies summarized in Table 2.3 and Table 2.4 provide insights into the dietary and physical activity behaviours of adolescents in SSA. Due to the number of studies reviewed studies, and the number of SSA countries represented, the findings cannot be generalized. This thesis was conducted to provide evidence specific to Kenya.

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Table 2.4: *Studies on the dietary behaviour of adolescents in SSA*

Author (Year)	Sample (Setting)/Method/Findings
Adesina et al. (2012)	<p>N= 960 adolescents aged 10-19 years (Port Harcourt, Nigeria) Conducted in the school environment Method:</p> <ul style="list-style-type: none"> • 24 hr dietary recall • Non-quantified FFQ (snack and beverage consumption) • Time spent watching TV • Prevalence of overweight and obesity using BMI <p>Findings:</p> <ul style="list-style-type: none"> • 6.3% overweight and 1.8% obese. • 30 % consume sugar sweetened beverages at least three times each week • 71.6% consume energy dense snacks such as biscuits, pastries and chocolates at least three times each week • 42.3% watch TV at least three times each week • Snacking associated with higher SES
Dapi et al. (2005)	<p>N=52 adolescents aged 12-15 years (1 Urban and 1 rural region, Cameroon) Conducted in the school environment Method:</p> <ul style="list-style-type: none"> • A non- quantified FFQ • BMI, Arm Muscle Area, Hip-to-Waist Ratio and total skin folds <p>Findings:</p> <ul style="list-style-type: none"> • 23.2% of total food intake among urban adolescents comprised of junk food vs. 14.2 among rural adolescents. Constituents of junk food not listed. • Most urban adolescents bought lunch food at school (ratios not given). • Rural adolescents had a higher BMI than urban adolescents though the difference was not significant (20.6 vs. 19.4). Although the difference may have been due to more muscle tissue among rural adolescents

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(Continued) Table 2.4: *Studies on the dietary behaviour of adolescents in SSA*

Author (Year)	Sample (Setting)/Method/Findings
Feeley et al. (2012)	<p>N=1451 students aged 13-17 years. (Soweto_Johannesburg, South Africa)</p> <p>Method:</p> <ul style="list-style-type: none"> Longitudinal survey on dietary practices at home, school and in the community (only school practices reported in this table). Data collected at ages 13, 15 & 17 Weekly dietary recall (a predetermined list used) and consumption frequency Possession of household items and maternal education as indicators for SES <p>Findings:</p> <ul style="list-style-type: none"> Common school lunch box foods (brought from home) were cheese, bread, fruit and fruit juice. Lunch box use was low and decreased with age >85% bought food from school shop; this increased with age 62% of foods purchased from school shop were sweets, crisps, cold drink, fried chips and white bread, for all ages Purchase of sweets, crisps, fruit juice, white bread and pies decreased with increasing age, and purchase of cold drinks, cake and fried chips increased with age. .
Maruapula et al. (2011)	<p>N=667 urban private & public schools and rural (all pubic) school students with mean age of 14.9 (SD 1.36) (urban and rural localities, Botswana)</p> <p>Conducted in the school environment</p> <p>Method:</p> <ul style="list-style-type: none"> Previous day dietary intake recall BMI <p>Findings:</p> <ul style="list-style-type: none"> Private school students of higher SES reported eating out more often (97.7% vs. 78.0%), ate more savoury energy dense snacks (1.00 vs. 0.41), sweet energy dense snacks (0.71 vs. 0.40) & fizzy drinks (0.42 vs. 0.11) all with $P<0.01$ compared with public school student of lower SES. <p>Overweight and obese students ate more vegetables compared with those with optimal BMI (0.68 vs. 0.37 servings, $P=0.012$) but also consumed more savoury energy dense snacks e.g., fried meat/cheese pies/French fries & potato chips (0.77 vs. 0.55 servings $P<0.001$)</p>

DIETARY AND PHYSICAL ACTIVITY BEHAVIOUR

(Continued) Table 2.4: *Studies on the dietary behaviour of adolescents in SSA*

Author (Year)	Sample (Setting)/Method/Findings
Nago et al. (2010)	<p>N= 553 adolescents aged 13-19 years (Cotonou, Benin) Conducted in the school environment Method:</p> <ul style="list-style-type: none"> • 24-hr diet recall for two non-consecutive school days, • Body weight status (BMI) <p>Findings:</p> <ul style="list-style-type: none"> • 40% of daily weight of food consumed on school days comprised out-of-home foods (OOH). • Street foods constituted 86% of food, energy & macronutrients from OOH. • 'Cereal and cereal products' and 'sweet foods' such as sweet beverages, candies, chocolate were consumed the most as food prepared away from home • 84% of all sweet foods consumed were food prepared away from home vs. 16% for home-prepared foods. • 8.3% overweight and 4.0% obese • No significant difference in the nutrition status between low & high consumers of food prepared away from home
Temple et al. (2006)	<p>N=476 students aged 12-16 years (Cape Town, South Africa) Conducted in the school environment Method:</p> <ul style="list-style-type: none"> • 24 hr diet recall of previous school day. • Location of school used as a proxy for SES <p>Findings:</p> <ul style="list-style-type: none"> • 69.3% of students purchased food from school. • Among students purchasing food, 70.0% of them purchased no healthy food, and 73.2% purchased two or more unhealthy foods. • Potato chips, candies & chocolates, soft drinks and French fries most frequently purchased (proportion of students: 46.3%, 46.0%, 33.2%, 25.6% respectively) • Students in high SES schools spent twice as much on food purchased at school.

2.5 Conclusion

In summary, owing to influences such as globalization, urbanisation and increased industrialization, the food environment in urban Kenya has changed to include the consumption of energy dense dietary items such as fast foods and sugar sweetened beverages (Dixon et al., 2007). In addition to changes in the food environment, urban settings in SSA countries such as Kenya has led to reduced opportunities for physical activity (Adeboye et al., 2012). Dietary guidelines by the WHO recommend the limited consumption of energy dense dietary items which tend to be high in fat, salt and, or sugar (WHO, 2004). According to the Food and Agricultural Organization (FAO), country specific food-based guidelines for the Africa region are available for only three African countries; Namibia, Nigeria and South Africa (FAO, 2009). The food-based guidelines in each of these three countries recommend the consumption of “mixed meals” (Namibia Food and Nutrition Guidelines, 2000; Nigeria Food and Nutrition Guidelines, 2003; South Africa Food and Nutrition Guidelines, 2004). On the issue of physical activity, the WHO provides recommendations for physical activity for various age groups (WHO, 2011c; WHO, 2011d; WHO 2011e). Among children and adolescents aged 5 to 17, daily engagement in 60 minutes of aerobic activities at a moderate intensity is recommended (WHO, 2011c).

The ANGELO framework developed by Swinburn et al. (1999) recognizes the role of environmental influences in the development of overweight and obesity. The excessive accumulation of body fat is one of the risk factors of NCDs (WHO, 2013c). NCDs such as CVD and T2D are a growing health problem worldwide (Murray et al., 2012), including in SSA (Dalal et al., 2011; de-Graft Aikins et al., 2010) and in Kenya (WHO, 2013b), a SSA country. The life course approach has been used to understand the development of NCDs (Kuh et al., 2004). According to the life course perspective, risk NCD risk factors such as physical inactivity and unhealthy eating practices can persist from early developmental stages of life to adulthood (Kuh et al., 2004). Based on the life course perspective, globally, adolescents are viewed as a population group at risk of NCDs due to their unhealthy dietary behavior coupled with physical inactivity. One of the “built” environments with significant influence on the diet and physical activity patterns of school going adolescents is the school setting (Kubik, Lytle, Hannan, Perry, & Story, 2003; Bell & Swinburn, 2004). As a result, The WHO has provided policy guidance for the development of school policies and

programmes aimed at promoting healthy eating and increasing the levels of physical activity in schools (WHO, 2008).

Currently, apart from the fact that NCDs is on the rise, little is known about their development among the Kenyan population, specifically, the risk profile of NCDs among the adult and non-adult Kenyan population. As noted in this review, there are some insights on the dietary and physical activity behavior of adolescents in SSA based on research from other SSA countries. The available research suggests nutrition transition among adolescents. This thesis aims to identify selected dietary and physical activity habits of a sub group of adolescents in Nairobi, Kenya who are believed to bear the highest risk of adopting poor dietary and physical activity behavior as a result of globalization, industrialization and changes in income levels. Unhealthy dietary behaviour and sedentary lifestyles among adolescents can be targeted through school policies and programmes that promote healthy eating and increase the levels of physical activity.

Chapter 3: METHODOLOGY

3.1 Overview

A cross-sectional survey was conducted to investigate selected dietary and physical activity behaviours among a sub-group of adolescents in Kenya.

3.2 Ethical approval and consent

Ethical approval for this research study was sought through the University of Canterbury Human Ethics Committee (UC HEC) in New Zealand (Appendix B1a). The UC HEC approved all changes that were made to the consent process (Appendix B1b-B1d).

In compliance with Kenyan Science and Technology Act, ethical approval was also sought from African Medical Research Foundation Ethics and Scientific Review Committee (AMREF ESRC), a locally recognized ethical research committee. This was obtained on August 6, 2013 (Appendix B2). After obtaining local ethical clearance, the researcher proceeded to apply for a Kenyan Government research permit through the National Commission for Science, Technology and Innovation (NACOSTI) on August 6, 2013 and obtained a permit on August 20, 2013 (Appendix B3). The application and issuance of a Kenyan Government research permit must be preceded by ethical clearance by a locally approved Ethics Review Committee such as AMREF ERSC, and is a mandatory requirement before any research activities can be conducted.

Consent of the school principals was obtained in each of the five schools that participated in this survey, and also in the school where the pilot study was conducted (Appendix B4 - B9).

A confidentiality agreement was signed by each of the two research assistants used in this study (Appendix B10a-b)

3.3 Sample size

The sample size was calculated using the population survey approach in OpenEpi (http://www.openepi.com/v37/Menu/OE_Menu.htm). The prevalence of overweight among adolescents was set at 13.7 percent, as estimated by (Mberia (2012). The confidence level was

set at 80 percent, and the Design Effect was set at a value of 1.0. The calculated sample size was 222. An attrition rate of 35 percent was assumed and a sample size of 300 participants was planned.

3.4 Study setting

The cross-sectional survey was conducted in Nairobi, Kenya. Nairobi is the capital city of Kenya, a Sub-Saharan African country. Participants were recruited from five private high schools, all of which cater to households likely to be of at least middle-income SES. The schools are henceforth referred to as schools A, B C, D and E.

3.4.1 Study setting and socio-economic status

In this study school of attendance was used as a proxy measure for SES. The education system in Kenya is segregated along a socio-economic gradient, with affluent households more likely to send their children to schools in the private sector (“A Brief Profile on Inequality”, 2014). Private high schools in Nairobi were identified using Kenya Open Data¹. According to the most recent estimates from the Kenya National Bureau of statistics (KNBS), in 2009, households in Kenya with a monthly expenditure less than 23, 670 Kenyan Shillings (KSh.) were classified as low income, between KSh. 23, 671 and 119,999 as middle income, and above KSh. 121,000 as high income (KNBS, 2013). Using this information and the available school fee structures of various private high schools in Nairobi, the schools cater to households likely to be of at least middle-income SES were identified. The use of proxy measures of SES is acceptable in studies where SES is not a primary objective (Doocy & Burnham, 2006), as in this study. Otherwise, SES information can be obtained from self-reported socio-economic data on parental measures related to household income, occupational status and household assets among others (Doku et al., 2010), however adolescents can be unwilling or more likely unable to disclose the relevant information (Doku et al., 2010).

School of attendance is used as a proxy measure of SES to identify adolescents likely to be influenced by the expanding formal fast food environment in Nairobi. In addition the

¹ Kenya Open Data is a government initiative to public make government data accessible online <https://opendata.go.ke>

adolescents are likely to have access to a range of extracurricular activities, especially in school, including both sport activities and sedentary activities such as surfing the Internet.

3.5 Pilot study

A pilot study was conducted among ten adolescents with the similar characteristics as the expected study participants. Consent was obtained from the school principal (Appendix B9) of a private high school (identified as school F) that caters to households likely to be of at least middle-income SES. The ten participants were a convenience sample. The participants completed the questionnaire and were allowed to seek clarification regarding the questions in the survey. A group discussion was used to further determine the clarity of the questions. The results of the pilot study allowed the researcher to change and adapt questions, to ensure face validity of the questionnaire.

The pilot study confirmed that all participants had the same understanding of the questions in the questionnaire. Also, it was established that the participants used either metric or imperial units to report their weight and height. For this reason, the questionnaire was revised and no units indicated on the questionnaire so that participants could report their height and weight using the units that suited them.

3.6 Sampling strategy

Permission was sought from the school principals of 11 private high schools eligible to participate in this study. The basis of eligibility in this study has been described in Section 3.4.1. The 11 high schools have a school fee structure that suggests that household expenditure would be likely to exceed KSh. 23, 671. Five of the 11 school principals assented to the research and these schools, (identified henceforth as schools A, B, C, D and E), were included the study. A convenience sample was recruited from schools A, B, C, D and E. Student volunteers were used as study participants. A convenience sampling strategy was used to foster the engagement of the students in the study. In addition, this sampling strategy was influenced by lack of access to a sampling frame.

3.7 Recruitment of participants

The recruitment of participants occurred in three stages as is described in Sections 3.7.1 to 3.7.3 below (See Figure 3.1).

3.7.1 Initial engagement and rapport building

Between August 1, 2013 and August 20, 2013, the researcher contacted the 11 high schools and scheduled an appointment with the schools' respective administrators. During this initial engagement, neither the permission of the school principals nor the voluntary participation of the students in this thesis was sought, as a Government research permit had not been received. During the meetings with the school administrators, the researcher expressed interest in conducting the research study, and obtained relevant phone contacts and email addresses.

3.7.2 School principal permission

The school principals of the 11 high schools were contacted after a research permit was obtained on August 20, 2014 (see Section 3.2). Initial contact was made by telephone to request an in-person meeting with the school principal in the 11 schools. Subsequently, an email that contained copies of the study information sheet for school principals (Appendix C1), the letters of ethics approval (Appendix B1a and B2) and the Kenyan Government research permit (Appendix B3) was sent to the school principals to request an in-person meeting. The school principals did not respond to the email within three days and therefore the researcher, hand delivered a package with the relevant study documents to the 11 schools.

Following the hand delivery of the relevant study documents, the school principals of eight out of the 11 schools contacted the researcher and scheduled a meeting in the following two weeks. During the meeting with each school principal, the purpose of the study as stated in the information sheet for school principals was discussed. Also, copies of all the supporting documents (ethics approval letters from UC HEC (Appendix B1a), ethics approval letter from ESRC AMREF (Appendix B2) and the Kenyan Government research permit (Appendix B3) were presented to the school principals. After the meeting with all the eight school principals, six expressed their interest in the schools participating in the study, however they requested for time during which they were to consult with the management team of the school. During this consultation period, the researcher maintained communication with the school principals and addressed all the questions raised regarding the study. The school principals of two of the six schools suggested that weight and height measurements be obtained on a voluntary basis rather than systematically for all the participants as the researcher had proposed. The reason for this was that it was a busy time of the year for the students as they were sitting exams and therefore only a limited amount of time was available for their participation in the study.

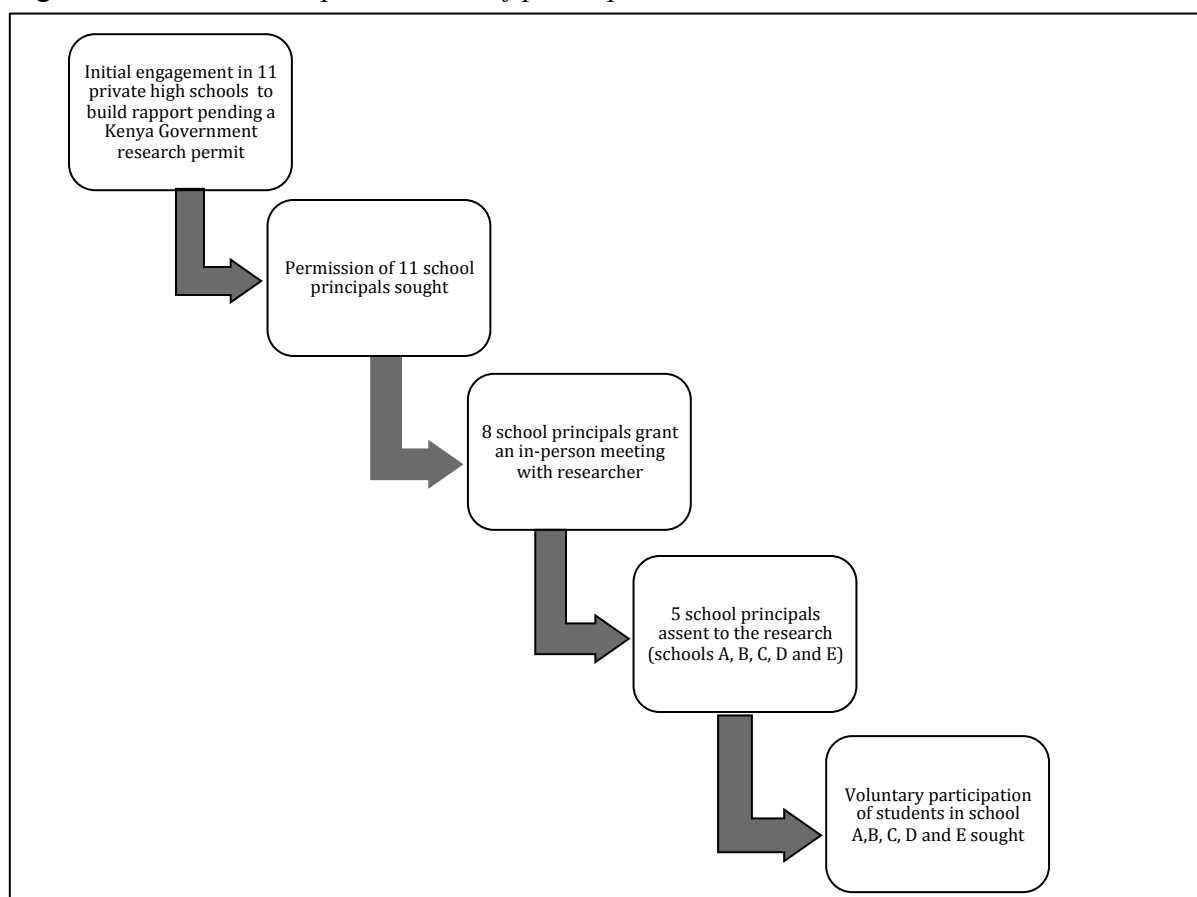
Furthermore, as long as anthropometric measurements were obtained on a voluntary basis, the school management of the two schools regarded the study as low risk. This meant the school principal could give overall consent for the students' participation in the study rather than have the researcher seek the consent of the participants' guardians and parents. With only four weeks of the data collection period left, the researcher accepted these recommendations. A request to amend the study methodology was made and subsequently approved by UC HEC (Appendix B4). All the school principals of six schools were informed of the study methodology changes. The principals of five of the schools (A, B, C, D and E) issued written consent (Appendix B4 - B9).

3.7.3 Seeking the voluntary participation of students

After assent was obtained in schools A, B, C, D and E the voluntary participation of students was sought (see Figure 3.1). On a date assigned by the principals of each schools, the researcher briefed all the students on the purpose of the study and requested their voluntary participation as was set out in the information sheet (Appendix C2). Due to differential consent by the various school principals, briefing of students was as follows: in schools A, B and C, all the students were briefed and invited to participate in the study; in school D, only Years 9 to 11 were briefed and invited to participate in the study, because the Year 12 and 13 students were away on a school camp; and in School E, the school principal assented to the participation of Year 12 and 13 students only, and therefore only these students were briefed.

During the briefing session, the students were informed of the designated "study post" where an information sheet for students (Appendix C3), the study questionnaire and a 'healthy weight leaflet' (Appendix C4) could be obtained. Also, students were informed of the two research assistants (Appendix B11), (trained nutritionists), who would be available to help them obtain their weight and height measurements on a voluntary basis, and to address issues and concerns regarding weight and height.

Figure 3.1: *Schematic representation of participant recruitment*



3.8 Questionnaire

A brief questionnaire was designed to investigate selected dietary and physical activity behaviour among a sub-group of adolescents in Kenya (Appendix D). Specifically the questionnaire explored the consumption of energy dense foods and beverages on a single school day, investigated the weekly consumption frequency of selected energy dense dietary items, investigated weekly participation in selected sports offered in Kenyan schools, and sought the attitude of adolescents towards diet, exercise and health.

The questionnaire was adapted from multiple tools that have been used among adolescents to assess dietary intake and levels of physical activity. For brevity, and to reflect the research setting, the questionnaires were not used in their entirety. The items in the questionnaire were adapted as follows:

- Participants reported their previous school day's consumption of energy dense foods and beverages. Intake was assessed in two school recess periods. The two recess periods are used to estimate intake on a full school day in this thesis. They also

reported the source of the meal they consumed on the previous school day in the lunchtime recess period. This item was adopted from the Tuck-shop student questionnaire used among adolescents in South Africa to assess dietary choices of adolescents in terms of the types and source of foods, energy dense snacks and beverages consumed during a school day (Temple, Steyn, Myburgh, & Nel, 2006). This item was used to explore the consumption of energy dense dietary items in the school environment. The validity of this questionnaire was not reported.

- Participants reported their weekly consumption of selected fast foods and beverages. This item was adapted from the FFQ developed by Nelson & Lytle (2009) to estimate fast food and beverage consumption by inquiring about fast food restaurant visitation. In this thesis, rather than inquire about fast food visitation, categories of foods offered by both fast food restaurants and other convenience food stores in Kenya were used in the questionnaire. The categories were developed as follows:
 - 1) Fried chicken and fried fish are popular fast food choices offered by local and international fast food restaurants. Due to their popularity, they are available in the school food environments from sources such as cafeterias. A single category identified in the questionnaire as ‘Fried chicken and fried fish’ was used to assess their consumption.
 - 2) French fries or potato chips and potato wedges are also popular foods offered by both local and international fast foods. In Kenya, French fries or potato chips and potato wedges are often sold separately as opposed to as a side dish usually served with fried chicken or fish. A single category identified in the questionnaire as ‘French fries or potato chips and potato wedges’ was used to assess their consumption.
 - 3) Pies, samosas, sausage rolls, burgers, hot dogs and pizza are available from most fast food restaurants. However, they are not as highly marketed as the first two categories of fast foods. This category includes items consumed both in between meals as snacks; that is pies, sausage rolls and samosa, and meals at lunchtime or supper that is burgers, hot dogs and pizza. For brevity, a single category identified in the questionnaire as ‘pies, samosas, sausage rolls, burgers, hot dogs and pizza’ was used to assess their consumption.

- 4) Biscuits, cake, mandazi¹, crisps² are common snack foods consumed in Kenya. They require no heating unlike the snack foods in the ‘Pies, samosas, sausage rolls, burgers, hot dogs and pizza’ category, which renders them popular among retailers such as in school tuck shops. A single category identified in the questionnaire as ‘biscuits, cake, mandazi, and crisps’ was used to assess their consumption.
- 5) Ice cream, chocolate and sweets comprise confectionery commonly consumed in Kenya, and available from school tuck shops and cafeterias. In Kenya, milk shakes are often made from ice cream and milk, which are blended together and thus readily available from school tuck shops or cafeterias already selling ice cream. A single category identified in the questionnaire as ‘ice cream, milk shake, chocolate and sweet’ was used to assess their consumption.
- 6) The consumption of beverages such as soda, fruit flavoured juice and energy drinks was assessed using a category identified in the questionnaire as ‘soda and fruit flavoured juices’. From the pilot study, these two beverages were identified as the commonly consumed options in the school environment.
- Participants’ weekly participation in selected sport activities, available in Kenyan high schools as extra-curricular activities, was assessed using a single item that had three categories of activities as follows: team sports, individual sports and gym-based work outs and was adapted from the Children’s Sport Participation and Physical Activity Study post primary questionnaire (Woods et al., 2010).

3.8.1 Questionnaire description

The items in the questionnaire sought information on the consumption of energy dense beverages (EDBs) and energy dense foods (EDFs) and the source of food consumed on a single school day, weekly consumption of selected EDBs and EDF, weekly engagement in selected sport activities, attitude regarding diet, exercise and health, and other personal details of the participants. The items are described below:

¹Mandazi is Kenyan sweet and deep fried dough.

² Deep-fried thinly sliced potatoes with salt or flavour added. Can also be made from green bananas and cassava, however potato crisps are the most popular.

- Items 1-4 assessed the consumption of EDBs and EDFs on a particular school day. Consumption was assessed in two school recess periods, break time ¹and lunchtime², as an estimate of a single school day's intake. Three broad categories of energy dense beverages were used. The categories used were fruit flavoured juices, milk-based beverages and carbonated beverages. The consumption of energy dense foods on the previous school day was investigated using 5 broad categories of foods. The rationale used in developing the food categories has been discussed in section 3.8.1. Participants were allowed the option of specifying foods and beverages or drinks consumed on the previous school day in order to further understand their dietary choices;
- Item 5 used a list of five sources of food to understand the opportunities available for the adolescents to eat or purchase food. The participants were allowed the option specifying a source other than those in the list;
- Item 6 estimated weekly consumption of energy dense foods and beverages, five categories of energy dense foods and one category of energy dense beverages were used. These categories have been described in section 3.8.1. Consumption was assessed using a scale with five levels as follows: never, once per week, two to three times per week, four to five times per week, and six and more times per week;
- Item 7 investigated the weekly frequency of participation in team sports, individual sports and gym-based workouts. Participation in these selected physical activities was assessed using a scale with five levels as follows: never, once per week, two to three times per week, four to five times per week, and six and more times per week;
- Item 8 used the statement 'diet and exercise are important for health' to investigate attitude regarding diet, exercise and health. A five-point Likert scale, which ranged from strongly disagree to strongly agree was used;

¹¹ Break time is a school recess period in schools in Kenya that usually starts at around 10:30 am and lasts between 15 minutes to 30 minutes

² Lunchtime is a school recess period in schools in Kenya that usually starts at 1pm and last between 45 minutes and 1 hour during when student might consume a lunch meal

- Item 9 sought the participants' date of birth, gender, and self-reported weight and height measurements.

3.8.2 Questionnaire validation

Content validity was assessed using the expertise of researchers at African Population Health and Research Center (APHRC) who reviewed the questionnaire and provided feedback and comment on its clarity and relevance including the content of the questionnaire in terms of adequacy of the range of the selected food items, and sport activities. Revisions were made accordingly.

Face validity was assessed in a pilot study as described in Section 3.5. The pilot study was used to improve the face validity of the questionnaire. Specifically, the following revisions were made: no unit of measurement was specified for height and weight measures so that respondents could report these measures using either metric or imperial units of measurement and no food portion sizes were used because the participants in the pilot study were unable to recall the portion sizes of food and energy dense snacks they consumed. However, the participants were able to estimate beverage consumption using a glass as a unit of measurement, therefore this was retained for use in the study.

A Confirmatory Factor Analysis (CFA) was performed to test the construct validity of the questionnaire using the measurement model. The latent variables were “food consumption frequency” and “sports engagement”, and the manifest variables were the following questions: questionnaire items 6 and 7 (Section 3.8.1).

3.9 Data collection procedures

Data collection differed between the schools. A “study post” was set up in all the schools. In schools A, B and E the “study post” was a classroom assigned to the researcher, in schools C and D the “study post” was a table was used to set up outside the dining hall. All the participants collected relevant material from the “study post” and thereafter completed the questionnaire during their free time such as in their recess periods. In schools A, B, C, and E all the participants returned their self-administered questionnaires the morning of the next

day, which was a school day. In school D, recruitment and data collection took place in a two-hour study period during when participants self-administered and returned the questionnaire.

In all the schools, the study research assistants helped participants to determine their height and weight measurements on a voluntary basis. This was done in two corners (for male and female participants) of the room assigned to the researcher in schools A, B and E. Two private booths (for male and female participants) were set up using coat stands and bed sheets as curtains. Two portable Seca stadiometer (Seca 217, Seca GmbH & Co.) were used to measure participants' height in centimetres. Participants were requested to take off their shoes before their height was determined. Two portable Seca weighing scales (Seca 874, Seca GmbH & Co.) were used to measure the participants' weight in kilograms. Due to time constraints, only one reading for both height and weight was taken for each participant. Extra clothing such as scarves, jackets and shoes were taken off before the participants were weighed.

In schools A, B and C, all the students who were briefed about the study were invited to obtain their measures regardless of whether they were participants in the study or not. This was done so that all students could access the services of the research assistants, trained nutritionists. Also, it ensured anonymity of the participants who turned up for their height and weight measurement. The research assistants recorded each student's measurements on a weight and height data sheet as proposed (Appendix E) and handed it to the respective student. It was hoped that participants would have a reference to use when filling the self-administered questionnaire. Generally, the response by students to obtain their measurement was low. In total, 29 students obtained their measurements in school A and 32 in school B. No student was measured in school C. In school A and B, it is unknown how many of the students who obtained their height and weight measurements participated in the study and returned a completed questionnaire. The low turn out may be due to lack of allocation of a specific time in the course of the school day when students could obtain their measures. Most students did so during the recess periods.

In school D, during a two-hour school study period, Year 9 to 11 students were briefed on the study, and interested students voluntarily participated in the study. They were invited to voluntarily obtain their height and weight measures with the help of the study research assistants. Forty percent ($n = 38$) of the participants had their weight and height measures obtained with the help of the study research assistants as they returned their questionnaires. In

school E, none of the students turned up for weight and height measurement. A university expo was held in school on the same week during when the study was conducted in the school. This may explain the poor turnout for weight and height measurement.

In all the schools, data collection was conducted between Tuesday and Friday as is shown in Table 3.1 below.

Table 3.1: Data collection schedule

School	Date signed consent obtained	Date of briefing and issuance of questionnaires	Date returned questionnaires collected
School A	12-09-2013	17-09-2013	18-09-2013
School B	06-09-2013	10-09-2013	11-09-2013
School C	17-09-2013	26-09-2013	27-09-2013
School D	10-09-2013	19-09-2013	19-09-2013
School E	24-09-2013	25-09-2013	26-09-2013

3.10 Data Management

Completed questionnaires were stored at APHRC and later transferred to the School of Health Sciences, University of Canterbury. In both these locations, the questionnaires were kept in a locked cabinet.

Statistical Package for the Social Science (SPSS) Statistics Version 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp) was used to create a database on a password-protected computer at the School of Health Sciences. Only the researcher had access to the data. The primary study questions used predetermined categories to investigate consumption of energy dense foods and beverages during a school day, source of food consumed during a single school day, weekly consumption on selected energy dense foods and beverages, and weekly participation in selected physical activities. Also, participants' age, gender, weigh and height were investigated using a set of primary study questions. A set of variables was defined (Appendix F) from the primary study question.

Each of the primary study questions on the consumption of energy dense beverages and foods during a school day and the source of food consumed on a school day included a secondary

study question in the form of “other, please specify”. Two secondary study questions were derived from the primary study questions as follows: ‘Other than energy dense foods and beverages, what did you consume on a previous school day?’ and ‘Other than the sources of food listed in the questionnaire, where did you obtain the food you consumed in the lunchtime recess during a previous school day?’ The responses from the secondary study questions were compressed into pre-existing variables or recoded into new variables as appropriate (Appendix F). For both the primary and secondary study variables derived from primary and secondary study questions respectively, number codes were used for categorical variables and ordinal data (Appendix F). The ordinal data in this study was collected using a scale with five levels as follows: never, once per week, two to three times per week, four to five times per week, and six and more times per week. The responses were recoded as follows: never and once per week into ‘Rarely’, two to three times per week into ‘occasionally’, and four to five times per week and six and more times per week into ‘frequently’ (Appendix F). Body Mass Index (BMI) was calculated from the anthropometric data. A box plot was used to identify extreme BMI values ($n = 6$) in the sample. For each participant with an extreme BMI value, only the BMI data was omitted from analysis, that is, other study variables were retained for analysis. BMI percentiles were established using CDC growth charts (Kuczmarski et al., 2000), as is appropriate for population groups between five and 19 years. The BMI percentiles were collapsed into ordinal categories as follows: a BMI below the 5th percentile as underweight, a BMI between the 5th percentile and the 85th percentile as healthy weight, a BMI for age greater than the 85th percentile but less than the 95th percentile as overweight and a BMI above the 95th percentile as obese.

The data was checked for errors against the questionnaires. All missing values were confirmed from the questionnaires as missing. Missing values in this study were treated as responses not revealed by the participants. For the mutually exclusive items in the questionnaire (weekly consumption of selected energy dense dietary items, weekly participation in sport activities, attitude of adolescents towards diet, exercise and health, and age, gender, weight and height) the response rate ranged between 72.1 percent and 98.5 percent. The response rate was lowest for the height variable.

The completed questionnaires will be held securely for the next five years at the University of Canterbury and thereafter destroyed.

3.11 Data Analysis

SPSS version 20.0 was used to analyze the data. For each categorical variable, a percent frequency distribution table was used to show their frequency in the sample. Graphs were used to illustrate the distribution of the data.

Bivariate analysis was conducted to explore associations and their strengths between the dietary, physical activity and attitude variables, and gender and categorized age. Chi-square test of trend was used to determine whether there was a trend in the distribution of the sample across the dietary, physical activity and attitude variables with gender and categorized age group. Spearman's correlation was used to measure the strength of the trend.

Chapter 4: Results

4.1 Overview

The results of this study, a cross-sectional survey, are presented in this chapter. The aim of the cross-sectional survey was to explore and investigate the consumption of energy dense dietary items and participation in sport activities among high school students. This was achieved by setting the following three objectives:

- To assess the consumption of energy dense foods and beverages during a school day (including the source of foods consumed in the school environment);
- To assess the weekly consumption of selected energy dense foods and beverages; and
- To explore participation in selected sport activities within the school environment.

In addition, to further understand the study population, two further objectives were set

- To determine body weight status; and
- To establish attitude regarding the importance of diet and physical activity for health.

Four hundred and two respondents were recruited from five private high schools that cater to households likely to be of at least middle-income SES (schools A, B, C, D and E). The procedure used to assess socio-economic status of the respondents was described in the Chapter 3.

Respondents in schools A, B and C (n = 277), were recruited from Form ¹ 1 through to 4. In school D respondents were drawn from Year ² 9 to 11 (n = 94), and in school E respondents (n = 36) were drawn from and Year 12 and 13. The average response rate in the schools A, B and C was 27.5 percent, 52.2 percent in school D and 67.2 percent in school E. As has been

¹ Schools A, B and C follow the Kenyan curriculum, which uses Form to distinguish each level of study in high school.

² Schools D and E follow the British curriculum, which uses 'Year' to distinguish each level of study in high school

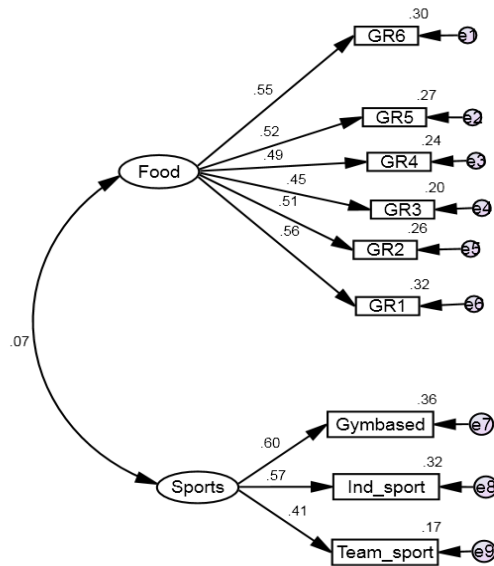
noted in section 3.11, the objective determination of respondents' height and weight was not possible. Furthermore, of the respondents who self reported both their height and weight measurements 68 percent ($n = 274$), there was no way of validating the self reported measures.

The face validity of the survey instrument was assessed using a pilot study among 10 respondents. The results of the pilot study are presented in Chapter 3. The construct validity of the questionnaire was estimated by specifying a measurement model (confirmatory factor analysis with two factors) as explained in the "methods" chapter (see section 3.8.2). The food consumption frequency latent variable (labelled as "Food" in Figure 4.1 below) had 6 variables whose standard regression weights ranged from 0.45 and 0.56. The sports engagement latent variable (labelled as "Sports in Figure 4.1) had 3 variables whose standard regression weights values ranged from 0.41 to 0.60. The correlation coefficient between the two latent variables (food consumption frequency and sports engagement) was small ($r = 0.07$).

The findings of this study are presented as follows:

- Age and gender of the respondents;
- Consumption of energy dense beverages on the previous school day;
- Consumption of energy dense food on the previous school day;
- Weekly consumption of selected energy dense foods and energy dense beverages;
- Weekly participation in selected physical activities; and
- Attitudes to the importance of diet and physical exercise for health.

Figure 4.1: *Path analysis diagram showing standardized regression weights of the food frequency and sports engagement observed variables.*



4.2 Age and gender of the respondents

The age of the respondents who reported their age (N = 386, 96%) ranged from 13 to 19 years (see Figure 4.1). The average age of the respondents was 16 years. Most of the respondents (98.5%, n = 396) reported their gender. Forty eight percent (n = 192) of the respondents were female and 51 percent (n = 204) were male.

Two age groups were created, 13-15 years and 16-19 years for subsequent cross-tabulation. Among the respondents who reported their age (n = 386, 96%), 43 percent were aged between 13-15 years and 57 percent (n=217) were aged between 16-19 years. A total of 385 (95.8%) respondents reported both their age and gender as was requested in the self-administered

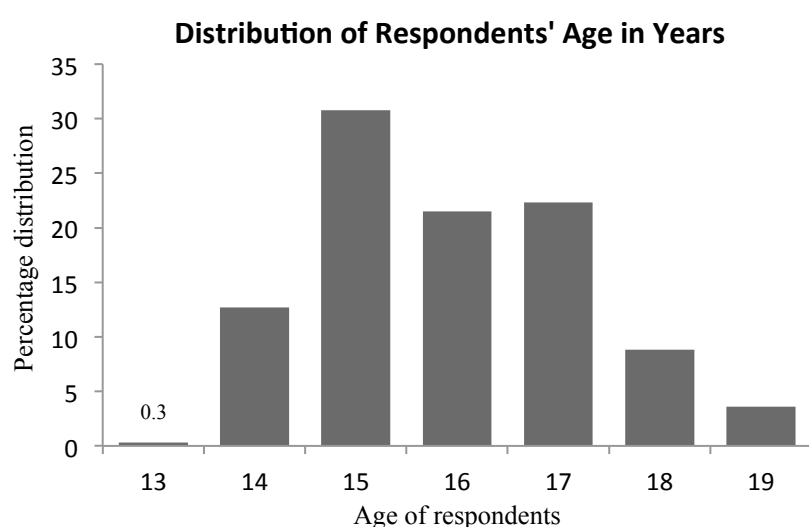
questionnaire. The age and gender distribution of the participants is shown in Table 4.1 below.

Table 4.1: *Distribution of categorized age in years, and gender*

Variable	Category	n (%)
Age group (years)	13 to 15	169 (43.8)
	16 to 19	217 (56.2)
Gender	Females	192 (48.5)
	Males	204 (51.5)

Note: Only 386 respondents reported their age and only 396 respondents reported their gender.

Figure 4.2: *Distribution of respondents' age in years*



4.3 Consumption of energy dense beverages at school

One of the objectives of this study was to determine whether the respondents consumed energy dense beverages (EDBs) on a particular school day. Respondents reported their consumption of EDBs with the aid of broad EDB categories (e.g., fruit flavoured non-carbonated beverages and carbonated beverages).

The same categories were used to assess intake in the two recess periods as an estimate of a single day's intake. The number of categories selected by each respondent in each of the two recess periods was summed up to estimate the total number of times a respondent consumed an EDB on a single school day. Selection of one EDB category indicated the consumption of an EDB once, and the selection of two EDB categories, indicated the consumption of an EDB twice etc. a particular school day.

Table 4.2 shows that the majority of the respondents consumed an EDB at least once on the school day assessed (n = 331, 82.3%). Most of the respondents (n = 189, 47%), consumed an EDB at least twice.

The respondents who consumed an EDB at least thrice and more times, are compiled into one group and are analysed this way in subsequent analysis.

Table 4.2: *Distribution of total number of energy dense beverage (EDB) categories selected by respondents (N=402)*

Total number of EDB categories selected	Reported EDB consumption	n(%)
None	Did not consume an EDB	71(17.7)
One	Consumed once	99(24.6)
Two	Consumed twice	189(47)
Three and more	Consumed thrice and more times	43(10.7)

Note: 1. The same categories were used to assess consumption of EDB in two recess periods as an estimate of a single school day's intake.

2. For each respondent, the total number of EDB categories selected was determined by summing up the EDB categories selected in each of the two recess periods

3 Selection of one EDB category indicated the consumption of an EDB once, and two EDB categories, indicated the consumption of an EDB twice etc.

4. Based on the number of EDB categories used in each recess period, the minimum total number of EDB categories possible is zero and maximum is six.

4.3.1 Gender and age group differences in the consumption of EDB at school

Table 4.3: *Cross tabulation of energy dense beverage (EDB) consumption on a single school day, by gender (N = 396) and age group (N = 386)*

Reported EDB consumption	Females	Males	13 to 15 years	16 to 19 years
	n (%)	n (%)	n (%)	n (%)
Did not consume an EDB	34 (47.9)	37 (52.1)	32 (45.7)	38 (54.3)
Consumed once	53 (53.5)	46 (46.5)	43 (44.3)	54 (55.7)
Consumed twice	89 (48.4)	95 (51.6)	70 (39.3)	108 (60.7)
Consumed thrice or more	16 (38.1)	26 (61.9)	24 (58.5)	17(41.5)

Gender difference statistics: $\chi^2(3, N=396) = 2.8, p = 0.2$; $r_s = 0.05, p = 0.3$

Age group difference statistics: $\chi^2(3, N = 386) = 5.2, p = 0.08$; $r_s = -0.15, p = 0.8$

Note: 1. A reported EDB consumption of once means the respondent selected one EDB category and thus consumed an EDB at least once, and likewise for none, twice etc.

2. Based on the number of EDB categories used in each recess period, the minimum total number of EDB categories possible is zero and maximum is six.

3. Only 396 respondents reported their gender (female, n = 192 and males, n = 204)

4. Only 386 respondents reported their age (13 to 15 years, n = 196 and 16 to 19 years, n = 217)

Table 4.3 above reports the number of EDB categories selected by respondents, by gender, and age group (13 to 15 and 16 to 19 years). Subsequently respondents in the 13-15 years age

group are referred to as younger respondents and those in the 16-19 years age group are referred to as older respondents.

As is shown in Table 4.3 above, the consumption of EDB categories did not vary with gender, even though male respondents were more likely to report the consumption of EDB twice or more times on the single school assessed, although this trend was not significant. Also, EDB consumption did not vary with age group.

4.3.2 Reported water consumption on the previous school day.

In each recess period, respondents had the option to report their consumption of other beverages and drinks other than the ones specified in the questionnaire. A complete distribution of reported consumption of other drinks and beverages is shown in Appendix G1. Considering each recess period, water was the drink that was reported by the highest proportion of respondents (break time recess period: 18.7%, n = 75, lunchtime recess period: 22.6%, n = 91, see Appendix G1).

Total reported water consumption was calculated by summing up each respondent's reported water consumption in the two recess periods. The majority of the respondents (71.6 %, n = 288) did not consume water on the previous school day as is shown in Table 4.4 below.

Table 4.4: *Total reported water consumption of water on the previous school day (N=402)*

Total reported water consumption	n(%)
Did not consume water	288(71.6)
Consumed water once	62(15.4)
Consumed water twice	52(12.9)

Note: Total reported water consumption was calculated by summing up each respondent's reported water consumption in the two school recess periods.

4.3.3 Gender and age group differences in the reported water consumption

Table 4.5: Cross tabulation of total reported water consumption with gender ($N = 396$) and age group ($N=386$)

	Females	Males	13 to 15 years	16 to 19 years
Total reported water consumption	n(%)	n(%)	n(%)	n(%)
Did not consume water	119 (41.9)	165 (58.1)	113 (41.1)	162 (58.9)
Consumed water once	37 (59.7)	25 (40.3)	27 (44.3)	34 (55.7)
Consumed water twice	36 (72)	14 (28)	29 (58)	21 (42)

Gender difference statistics: $\chi^2 (2, N = 396) = 19.1, p < 0.001$; $r_s = -0.2, p < 0.001$

Age group difference statistics: $\chi^2 (2, N = 386) = 4.92, p = 0.04$; $r_s = -0.1, p = 0.1$

Note: 1. Total reported water consumption was calculated by summing up each respondent's reported water consumption in the two school recess periods.

2. Only 396 respondents reported their gender (Female, $n = 192$ and males, $n = 204$).

3. Only 386 respondents reported their age (13 to 15 years, $n = 196$ and 16 to 19 years, $n = 217$).

Table 4.5 above is based on Table 4.4 above and reports total reported water consumption, by gender and age group.

As is shown in Table 4.5, female respondents were more likely than male respondents to report the consumption of water (59.7% vs. 40.3%). However the association between water consumption and gender was weak ($r_s = -0.2, p < 0.001$).

Also, Table 4.5 below shows that older respondents were likely to report that they did not consume water on the previous school day (58.9% vs. 41.1%) whereas younger respondents were more likely to report the consumption of water twice on the previous school day (58% vs. 42%). However, the association between age group and water consumption was not statistically significant.

4.3.4 Association between the consumption of an energy dense beverage (EDB) and water in the single school day

Table 4.6 below is a cross-tabulation of water consumption and EDB consumption.

As is shown in Table 4.6, on the school day assessed, the majority of respondents who reported the consumption of water twice on a previous school day did not consume an EDB ($n = 33, 63.5\%$). Also, most of the respondents who did not report the consumption of water, reported the consumption of an EDB twice ($n = 168, 58.3\%$).

There was a significant negative but weak association between the number of times respondents opted to consume water or an EDB during two recess periods ($r_s = -0.5, p < 0.001$). This suggests that the consumption of water is likely to displace the consumption of an EDB and vice versa.

Table 4.6: *Cross tabulation of water consumption with EDB consumption (n=402)*

Reported water consumption	Reported EDB consumption			
	None	Once	Twice	Thrice and more
Did not consume	18(6.2)	66(22.9)	168(58.3)	36(12.5)
Consumed once	20(32.3)	27(43.5)	10(16.1)	5(8.1)
Consumed twice	33 (63.5)	6 (11.5)	11(12.2)	2(3.8)

$r_s = -0.5, p < 0.001$

Note: 1. Total reported water consumption was calculated by summing up each respondent's reported water consumption in the two school recess periods.

2. A reported EDB consumption of once means the respondent selected one EDB category and thus consumed an EDB at least once, and likewise for none, twice etc.

4.4 Consumption of energy dense foods at school

An objective of this study was to determine whether the respondents consumed energy dense foods (EDFs) on a particular school day. With the aid of broad EDF categories (e.g., “Biscuits, cakes, mandazi¹” and “French fries and potato wedges”), respondents reported their consumption of EDFs.

The same categories were used to assess intake in the two recess periods as an estimate of a single day's intake. The number of categories selected by each respondent in each of the two recess periods was summed up to estimate the total number of times a respondent consumed an EDF on a single school day. Selection of one EDF category indicated the consumption of an EDF once, and two EDF categories, indicated the consumption of an EDF twice etc. on a particular school day.

Table 4.7 below show that the majority of the respondents consumed an EDF at least once on the school day assessed (n = 355, 88.4%).

The respondents who selected more than three EDB categories, were compiled into one group and are analysed this way in subsequent analysis.

¹ Mandazi is Kenyan sweet and deep fried dough.

Table 4.7: *Distribution of total number of energy dense food (EDF) categories selected by respondents (N=402)*

Number of EDF categories selected	Reported EDF consumption	n (%)
None	Did not consume	47(11.7)
One	Once	98(24.4)
Two	Twice	137(34.1)
Three and more	Thrice and more	120(29.9)

Note: 1. The same categories were used to assess consumption of EDF in two recess periods as an estimate of a single school day's intake.

2. For each respondent, the total number of EDF categories selected was determined by summing up the EDF categories selected in each of the two recess periods

3. Selection of one EDF category indicated the consumption of an EDF once, and two EDF categories, indicated the consumption of an EDF twice etc.

4. Based on the number of EDF categories used to assess consumption, the minimum total number of EDF categories possible is zero and maximum is ten.

4.4.1 Gender and age group differences in the consumption of EDFs at school.

Table 4.8 below is a cross-tabulation of total number of EDF categories selected by each respondent by gender and age group.

As is shown in Table 4.8 below, there was no significance difference in the consumption of EDFs by gender. Table 4.8 also shows that EDF consumption did not vary by gender.

Table 4.8: *Cross tabulation of total number of energy dense foods (EDF) categories selected by respondents on the previous school day with gender (N=396) and age group (N= 386)*

Reported EDF consumption	Females n (%)	Males n (%)	13 to 15 years n (%)	16 to 19 years n (%)
Did not consume	23 (48.9)	24 (51.1)	17 (37)	29 (63)
Once	50 (52.1)	46 (47.9)	41 (43.6)	53 (56.4)
Twice	61 (45.2)	74 (54.8)	51 (38.3)	82 (61.7)
Thrice and more	58 (49.2)	60 (50.8)	60 (53.1)	53 (46.9)

Gender difference statistics: $\chi^2 (3, n = 396) = 1.1, p = 0.4; r_s = 0.02, p = 0.8$

Age group difference statistics $\chi^2 (3, n = 386) = 6.5, p = 0.09; r_s = -0.1, p = 0.07$

Note: 1. The number of EDF categories selected is used to represent the number of food consumption opportunities during which an EDF was opted for on the previous school day

2. Based on the number of EDF categories used to assess consumption, the minimum total number of EDF categories possible is zero and maximum is ten.

3. Only 396 respondents revealed their gender (Female, n = 192 and males, n = 204)

4. Only 386 respondents revealed their age (13 to 15 years, n = 196 and 16 to 19 years, n = 217)

4.4.2 Reported consumption of mixed meals¹ on a single school day.

In each recess period, respondents had the option to report their consumption of foods other than the ones specified in the questionnaire. The distribution of reported consumption of other foods is given in Appendix G2 and Appendix G3.

Considering each of the two recess periods, the majority of the respondents did not report the consumption of foods other than those listed in the questionnaire (break time: 90.7%, $n = 370$ and lunchtime: 61.2%, $n = 246$, Appendix G2 and Appendix G3 respectively). Among the respondents who reported the consumption of other foods (38.8%, $n = 156$), the majority reported the consumption of a variety of mixed meals at lunchtime (91%, $n = 142$) (Appendix G3).

4.4.3 Association between the consumption of a mixed meal at lunchtime and an energy dense food(s) (EDF) in a single school day

Table 4.9 below is a cross tabulation of reported consumption of a mixed meal with the total number of EDF categories selected on the previous school day for each respondent. Most of respondents who did not report the consumption of a “mixed meal, consumed an EDF in three and more food consumption opportunities ($n = 105$, 40.4%). Similarly, most of the respondents who consumed a mixed meal consumed an EDF in one and none of the food consumption opportunities ($n = 77$, 61.2%). There was a weak and significant negative association between the consumption of a mixed meal and the consumption of EDFs ($r_s = -0.42$, $p < 0.001$). This suggests that the consumption of a mixed meal is likely to displace the consumption of an EDF and vice versa.

¹ Mixed meals are typical in Kenya and are meals comprise a starchy food and vegetables or a starchy food, vegetables and a source of protein eaten at lunch and supper. An example of a “mixed meal” is a dish of rice, beef curry and steamed cabbages.

Table 4.9: *Cross tabulation of reported consumption of a mixed meal with the total number of energy dense foods selected by respondents on the previous school (N = 402)*

Reported consumption of a “mixed meal”	Reported EDF consumption			
	None	Once	Twice	Thrice and more
Did not consume	14(5.4)	44(16.9)	97(37.3)	105(40.4)
Consumed	33(23.2)	54(38)	40(28.2)	15(10.6)

$r_s = -0.42$ ($N = 402$), $p < 0.001$

Note: 1. A reported EDF consumption of once means the respondent selected one EDF category and thus consumed an EDF at least once, and likewise for none, twice etc.

4.5 Source of food consumed by respondents in the lunchtime school recess period

Respondents were asked to select, from a predetermined list, a single source that best described where they obtained food consumed at lunchtime. The majority of respondents selected one source ($n = 340$, 84.6%). The results are presented in Table 4.10 below.

Respondents who selected more than one source ($n = 44$, 10.9%) are excluded from Table 4.10. Eighteen (4.5%) respondents did not select any source of food. Most of the respondents consumed a school provided meal at lunchtime. (see Appendix G4 for meals consumed are school provided lunch).

Table 4.10: *Sources of food consumed in the lunchtime recess period (n = 340)*

Source of food	n(%)
Tuck shop or canteen	52(15.3)
Fast food restaurant	14(4.1)
Supermarket	13(3.8)
School provided lunch	156(45.9)
Home-made lunch	105(30.9)

4.5.1 Gender and age group differences in the source of food consumed at lunchtime

Table 4.11 below is a cross tabulation of reported sources of food consumed at lunchtime by gender and age group. As is shown in Table 4.11 below, male respondents were more likely to consume a school provided lunch meal (59.7% vs. 40.3%; $p < 0.001$) and females were more likely to consume a home-made lunch meal, that is food or a meal brought to school from home (62.5 vs. 37.5; $p = 0.002$). Also Table 4.11 below shows that younger respondents were likely than older adolescents to obtain food at lunchtime from the tuck shop (55.1% vs. 44.9%; $p = 0.02$).

Table 4.11: *Cross-tabulation of source of food or meal consumed at lunchtime by gender (n = 335) and age group (n = 328)*

Source of food	Gender		p-value
	Females n (%)	Males n (%)	
Tuck-shop	26(52)	24(48)	0.41
Fast food	9(64.3)	5(35.7)	0.15
Supermarket	7(53.8)	6(46.2)	0.40
School-provided lunch	62(40.3)	92(59.7)	<0.001
Home-made lunch	65(62.5)	39(37.5)	0.002
Source of food	Age group (Years)		p-value
	13-15 n (%)	16-19 n(%)	
Tuck-shop	27(55.1)	22(44.9)	0.02
Fast food	5 (35.7)	9(64.3)	0.32
Supermarket	5(41.7)	7(58.3)	0.5
School-provided lunch	56(37.1)	95(62.9)	0.06
Home-made lunch	44(43.1)	58(56.9)	0.37

Notes: 1. 335 (83.3 %) of respondents reported their gender and selected one source that best described where they obtained the food or meal they consumed at lunchtime.

2. 328 (81.6%) of respondents reported their age and selected one source that best described where they obtained the food or meal they consumed at lunchtime.

4.6 Weekly consumption frequency of selected energy dense dietary items

Respondents reported their weekly consumption of selected energy dense foods and drink items. Consumption was assessed using a scale with five levels, which were combined into ‘Rarely’ (never and once per week), ‘Occasionally’ (two to three times per week, and four to five times per week), and ‘Frequently’ (six and more times per week).

As is shown in Table 4.12 below and Figure 4.2 below, the respondents have a preference for sweet dietary items. Items broadly categorised as savoury energy dense dietary items were rarely consumed by the majority of the respondents (‘pie, samosa, sausage roll, burger, hot dog or pizza’: 52 %, n = 209, ‘fried chicken or fish: 52.7%, n = 212, ‘French fries or chips, wedges’: 45.5%, n = 183). However among the sweet energy dense dietary items, apart from confectionery, most of the respondents frequently consume sugar sweetened beverages (46.5%, n = 187), and pastries such as biscuits and cakes (38.8%, n = 156).

Table 4.12: *Distribution of reported weekly consumption frequency of selected energy dense beverage and food categories (N=402)*

Food items	Frequency	n (%)
Savoury energy dense dietary items		
Pie, Samosa, Sausage Roll, Burger, Hot Dog, Pizza	Rarely	209(52)
	Occasionally	97(24.1)
	Frequently	66(16.4)
	Respondent <u>did not</u> specify frequency	30 (7.5)
Fried chicken, Fried fish	Rarely	212(52.7)
	Occasionally	122(30.3)
	Frequently	36(9)
	Respondent <u>did not</u> specify frequency	32(8)
French fries or chips ² , wedges	Rarely	183(45.5)
	Occasionally	130(32.3)
	Frequently	48(11.9)
	Respondent <u>did not</u> specify frequency	41(10.2)
Sweet energy dense dietary items		
Biscuits, cake, mandazi ³ , crisps	Rarely	137(34.1)
	Occasionally	69(17.2)
	Frequently	156(38.8)
	Respondent <u>did not</u> specify frequency	40(10)
Ice cream, milk shake, chocolate, sweets	Rarely	180(44.8)
	Occasionally	85(21.1)
	Frequently	97(24.1)
	Respondent <u>did not</u> specify frequency	40(10)
Soda, fruit flavoured juices	Rarely	106(26.4)
	Occasionally	82(20.4)
	Frequently	187(46.5)
	Respondent <u>did not</u> specify frequency	27(6.7)

Note:¹ Carbohydrates is shortened to carbs, ²French fries and chips are used interchangeably in Kenya, ³Mandazi is Kenyan sweet and deep fried dough.

4.6.1 Gender and age group differences in the weekly consumption of selected energy dense foods and beverages

As is shown in Table 4.13 below, males respondents were likely to report that they more frequently than females consume the dietary items broadly grouped as savoury energy dense

foods, although the association was only significant for items categorised as ‘French fries or chips, wedges’ ($n = 31, 66\%$ vs. $n = 16, 34\%$) ($p = 0.002$). However, according to the Spearman’s correlation, the association between gender and the consumption of ‘French fries or chips, wedges’ was weak ($r_s = 0.2, p = 0.001$).

Table 4.13 also shows that among the sweet energy dense items, apart from soda or fruit flavoured juices, female respondents were likely to report that they more frequently than males consume the dietary items, however these differences were not significant.

Of the savoury energy dense dietary items, older respondents are more likely to more frequently than younger adolescents consume French fries and, or wedges each week ($n = 31, 66\%$ vs. $n = 16, 34\%$), although these trends are marginally significant ($p = 0.06$). Younger adolescents are likely to report that they more frequently than older adolescents consume ice cream, milk shake, chocolate or sweets ($n = 50, 55.6\%$ vs. $n = 40, 44.4\%$; $p = 0.01$). However, this trend was weak as was determined by the Spearman’s correlation coefficient ($r_s -0.109, p = 0.042$).

Of all the dietary items investigated, and across both age groups, the highest proportion of respondents reported the frequent consumption of soda or fruit flavoured juices.

Table 4.13: Cross tabulation of weekly consumption of selected energy dense foods and beverages with gender and age group (years)

	Food items	Frequency	Females n(%)	Males n(%)	¹ p-value	13 to 15 n (%)	16 to19 n (%)	² p-value
Savoury items	Pie, Samosa, Sausage Roll, Burger, Hot Dog, Pizza	Rarely	112(54.1)	95(45.9)	0.05	84(41.8)	117(58.2)	0.3
		Occasionally	42(44.2)	53(55.8)		43(46.7)	49(53.3)	
		Frequently	27(41.5)	38(58.5)		30(46.2)	35(53.8)	
		Respondent <u>did not</u> specify frequency	11	18		12	16	
	Fried chicken, Fried fish	Rarely	110(52.4)	100(47.6)	0.3	93(45.8)	110(54.2)	0.05
		Occasionally	56(46.3)	56(53.7)		45(37.8)	74(62.2)	
		Frequently	17(48.6)	17(51.4)		20(57.1)	15(42.9)	
		Respondent <u>did not</u> specify frequency	9	21		11	18	
	French fries or chips ² , wedges	Rarely	107(58.5)	76(41.5)	*0.002	86(48.9)	90(51.1)	0.06
		Occasionally	58(45.3)	70(54.7)		51(40.5)	75(59.5)	
		Frequently	16(34)	31(66)		16(34)	31(66)	
		Respondent <u>did not</u> specify frequency	11	27		16	21	
Sweet items	Biscuits, cake, mandazi ³ , crisps	Rarely	69(51.5)	65(48.5)	0.331	60(45.8)	71(54.2)	0.46
		Occasionally	31(44.9)	38(55.1)		28(43.1)	37(56.9)	
		Frequently	78(50.3)	77(49.7)		67(43.8)	86(56.2)	
		Respondent <u>did not</u> specify frequency	14	24		14	23	
	Ice cream, milk shake, sweets	Rarely	89(49.4)	91(50.6)	0.24	70(40)	105(60)	*0.01
		Occasionally	37(46.4)	45(53.6)		32(38.1)	52(61.9)	
		Frequently	52(55.3)	42(44.7)		50(55.6)	40(44.4)	
		Respondent <u>did not</u> specify frequency	12	26		17	20	
	Soda, fruit flavoured juices	Rarely	60(57.1)	45(42.9)	0.1	43(43)	57(57)	0.11
		Occasionally	37(45.7)	44(54.3)		44(53.7)	38(46.3)	
		Frequently	88(47.6)	97(52.4)		77(42.8)	103(57.2)	
		Respondent <u>did not</u> specify frequency	7	18		5	19	

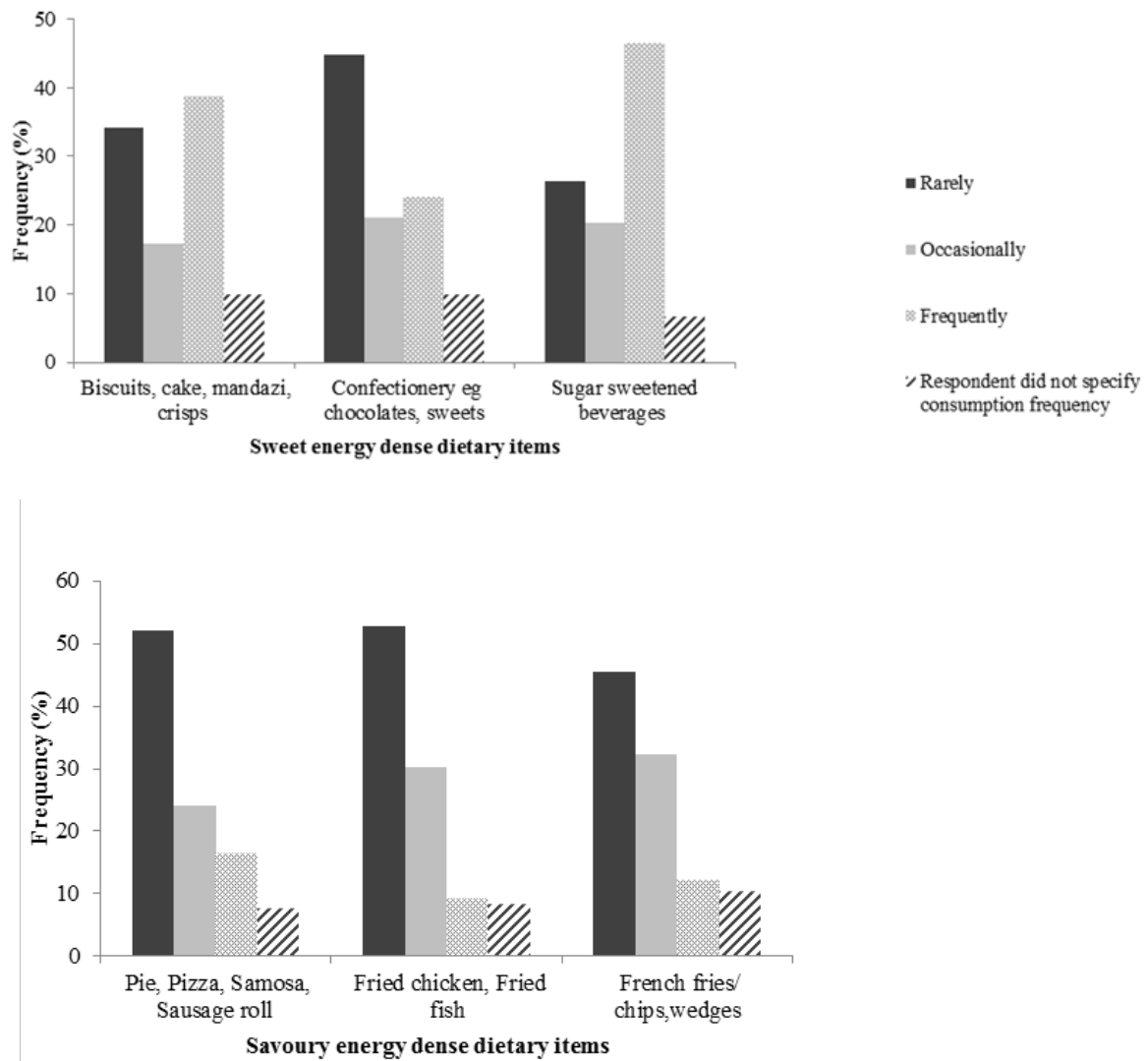
Note: ¹ Carbohydrates is shortened to carbs, ²French fries and chips are used interchangeably in Kenya,

³Mandazi is Kenyan sweet and deep fried dough.

¹ p-value for gender differences

² p- value for age group differences

Figure 4.3: *Weekly consumption frequency of selected energy dense beverages and foods*



4.7 Weekly participation frequency in selected sport activities

One of the objectives of this study was to understand the physical activity behaviour of adolescents within the school environment, using three categories of physical activity opportunities available in schools. Specifically this thesis was interested in whether adolescents engage in sports activities daily, or at least in the five days they are in school each week. The WHO recommends that adolescents should engage in aerobic activities daily for at least 60 minutes of aerobic activities at a moderate intensity (WHO, 2011a).

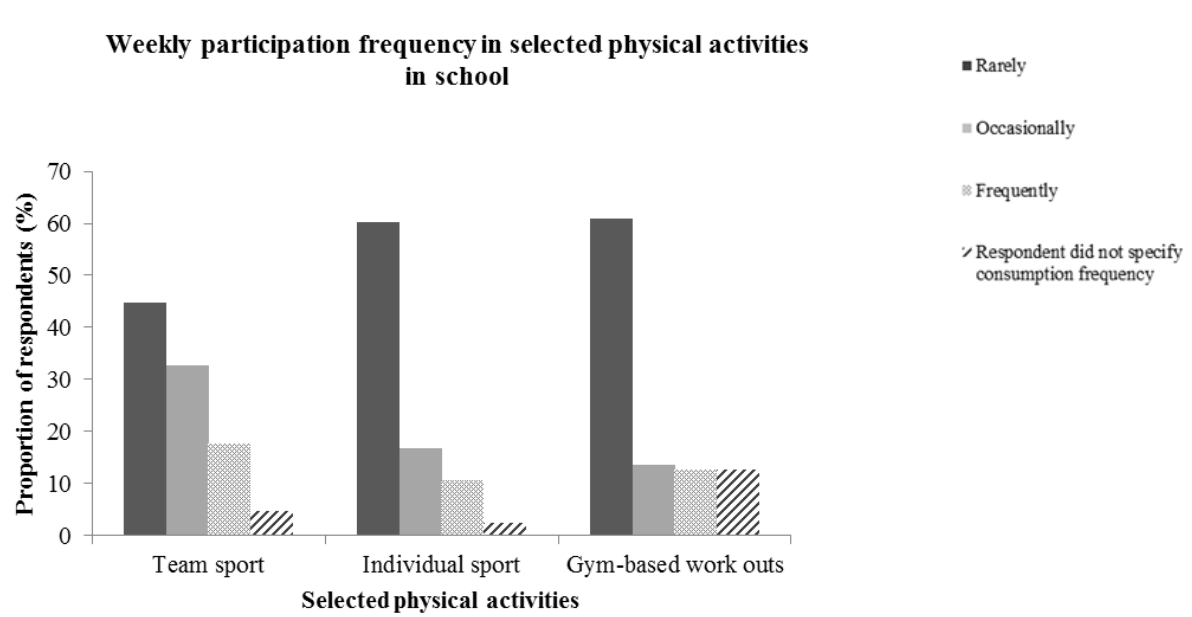
Weekly participation in selected physical activities was assessed using a scale with five levels, which were combined into ‘Rarely’ (never and once per week), ‘Occasionally’ (two to three times per week, and four to five times per week), and ‘Frequently’ (six and more times per week).

As is shown in Table 4.14 below and Figure 4.3 below, in general, respondents were likely to report that they participate in team sports than in individual and gym based workouts. A majority of the students reported that they rarely participated in individual sports (n = 242, 60.2%) and in gym based work-outs (n = 245, 60.9%). A notably lower proportion of respondents reported that they rarely participate in team sports (44.8%) than in individual sports and gym based work-outs. A total of 147 respondents (36%) reported that they rarely participated in all the three physical activities.

Table 4.14: *Distribution of respondents’ self-reported participation in selected physical activities while in school*

Selected physical activity	Frequency	n(%)
Team sport	Rarely	180(44.8)
	Occasionally	132(32.8)
	Frequently	71(17.7)
	Respondent <u>did not</u> specify frequency	19(4.7)
Individual sport	Rarely	242(60.2)
	Occasionally	67(16.7)
	Frequently	43(10.7)
	Respondent <u>did not</u> specify frequency	50(12.4)
Gym or gym class	Rarely	245(60.9)
	Occasionally	55(13.7)
	Frequently	51(12.7)
	Respondent <u>did not</u> specify frequency	51(12.7)

Figure 4.4: *Weekly participation frequency in selected physical activities while in school*



4.7.1 Gender and age group differences in the participation in sport activities

Table 4.15: Cross tabulation of participation frequency in selected categories of physical activities beverages with gender and age group.

Selected Sport activities	Frequency	n(%)		¹ p-value	13 to 15 (years)	16 to 19 (years)	² p-value
		Females	Males				
Team sport	Rarely	125(71)	51(29)	p<0.001	56(32.9)	114(67.1)	p<0.001
	Occasionally	49(37.1)	83(62.9)		75(58.1)	54(41.9)	
	Frequently	10(14.3)	60(85.7)		33(47.1)	37(52.9)	
	Respondent did not specify frequency	8	10		5	12	
Individual sport	Rarely	125(52.1)	115(47.9)	0.3	102(43.8)	131(56.2)	0.5
	Occasionally	39(58.2)	28(41.8)		27(42.2)	36(57.8)	
	Frequently	15(35.7)	27(64.3)		20(46.5)	23(53.5)	
	Respondent did not specify frequency	13	34		20	27	
Gym or gym class	Rarely	137(56.4)	106(43.6)	p<0.001	106(45.1)	129(54.9)	0.02
	Occasionally	18(33.3)	36(66.7)		31(56.4)	24(43.6)	
	Frequently	16(31.4)	35(68.6)		16(32)	34(68)	
	Respondent did not specify frequency	21	27		16	30	

Note: 1. ¹ p-value for gender differences

2. ² p- value for age group differences

3. Only 396 respondents revealed their gender (Female, n = 192 and males, n = 204)

4. Only 386 respondents revealed their age (13 to 15 years, n = 196 and 16 to 19 years, n = 217)

The WHO recommends that adolescents should engage in aerobic activities daily for at least 60 minutes of aerobic activities at a moderate intensity (WHO, 2011a).

As is shown in Table 4.15 above, male respondents were more likely than female respondents to report that they either frequently (n = 60, 85.7% vs. n = 10, 14.3%) or occasionally (n = 83, 62.9% vs. n = 46, 37.1%) participate in team sports ($p < 0.001$). Also males were more likely than females to report that they either frequently (n = 35, 68.6% vs. n = 16, 34%) or occasionally (n = 36, 66.7% vs. n = 18, 33.3%) in gym based work-outs ($p < 0.001$). The association between gender and participation in team sports and gym based work-outs was weak (respectively $r_s = 0.169$, $p = 0.001$; $r_s = 0.135$, $p = 0.011$).

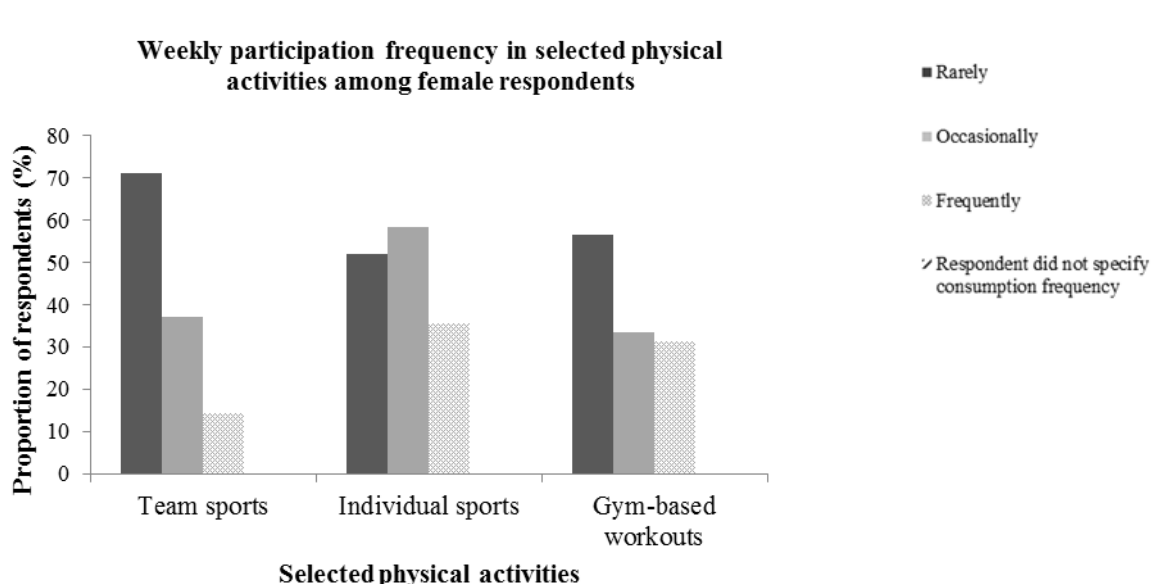
As noted in section 4.6, of the three physical activities assessed, respondents were more likely to report that they participated in team sports. A notably higher proportion of female respondents reported that they rarely participated in team sports ($n = 125$, 71% vs. $n = 51$, 29%) ($p < 0.001$). However, as previously noted the association between the reported weekly participation in team sports and gender was weak.

Regarding participation in the selected sports and age group differences, as is shown in Table 4.15 above, significant trends were noted for team sports and gym based workouts.

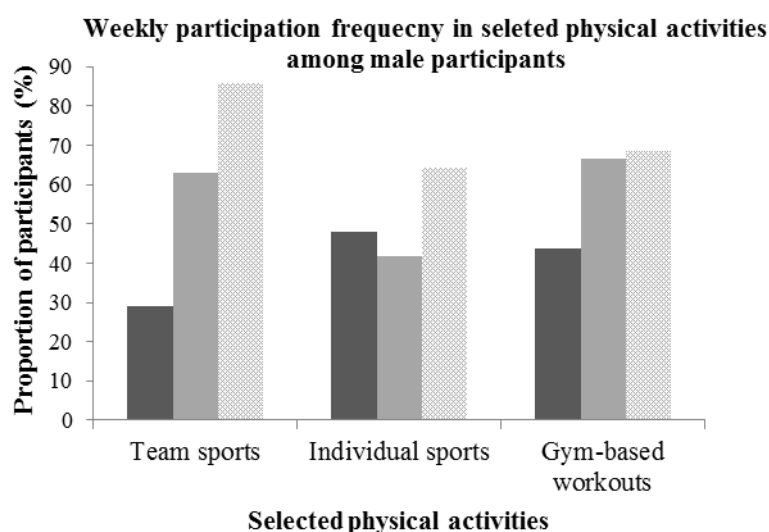
Older respondents were more likely than younger respondents to report that they rarely participate in team sports ($n = 114$, 67.1% vs. $n = 56$, 32.9%) or frequently participate in team sports ($n = 37$, 52.9% vs. $n = 33$, 47.1%). However, younger respondents were more likely than older respondents to report that they occasionally participate in team sports ($n = 75$, 58.1% vs. $n = 54$, 41.9%). The association between participation in team sports and age group was weak ($r_s = -0.202$, $p < 0.001$).

Older respondents were more likely than younger respondents to report that they rarely participate in gym based work-outs ($n = 129$, 54.9% vs. $n = 106$, 45.1%) or frequently participate in gym-based workouts ($n = 34$, 68% vs. $n = 16$, 32%). However, younger respondents were more likely than older respondents to report that they occasionally participate in team sports ($n = 31$, 56.4% vs. $n = 24$, 43.6%). However the association was weak.

Figure 4.4: Weekly participation frequency in selected physical activities by gender



(Continued) Figure 4.4: *Weekly participation frequency in selected physical activities while at school by gender*



4.8 Self-reported attitude regarding the statement, ‘diet and exercise are important for health’.

The attitude of respondents regarding the statement: ‘diet and exercise are important for health’ was assessed using a 5 level Likert-type scale that ranged from strongly disagree to strongly agree. The majority of the respondents indicated their attitude as was requested of them (94%, n = 378). As is shown in Table 4.24 below, the majority of the respondents strongly agreed and agreed that exercise and diet are important for health (88.1%, n = 333).

Table 4.16: *Distribution of respondents’ attitude regarding the following statement: **Diet and exercise are important for health***

Responses	n(%)
Strongly disagree	8 (2.1)
Disagree	3 (0.8)
Neither agree nor disagree	34(9.0)
Agree	141(37.3)
Strongly agree	192(50.8)

Note: 24 respondents did not indicate their attitude regarding the statement, Diet and exercise are important for health

4.9 Summary of results

The results in this chapter provide both an insight into the dietary behaviour of the adolescents who participated in this survey. The two recess periods used to assess consumption of energy dense dietary items are the two standard recess periods in Kenyan schools. The majority ($n = 331$, 82.3%) of the respondents reported the consumption of an EDB in the course of the school day assessed. The majority of respondents did not report the consumption of water during the previous school day (71.6%, $n = 288$). Respondents who did not consume water on the previous school day were likely to report the consumption of an EDB during the previous school day. The majority of the respondents consumed an EDF in the school day assessed ($n = 355$, 88.4%). The majority of respondents who reported the consumption of foods other than those in the survey instrument did so in the lunchtime recess period (39.3%, $n = 158$), and the majority of the foods indicated comprised a variety of mixed meals which were consumed predominantly sourced from, or consumed as part of a school provided lunch meal (35.3%, $n = 142$). There was a negative association although it was weak between the consumption of a “mixed meal” and the consumption of EDFs ($r_s = -.42$, $p < 0.001$). From the respondents’ weekly consumption of the selected sweet and savoury energy dense dietary items, there appears to be a preference for sweet over savoury dense dietary items. The most frequently consumed energy dense dietary items are pastries including Kenyan snack food ‘mandazi’ (38.8%, $n = 156$), and sugar sweetened beverages (46.5%, $n = 187$).

Of the selected sport activities, respondents engaged in team sports the most (team sports: 50.5%, $n = 203$ vs. individual sports: 27.4%, $n = 110$ and gym based work outs 26.4%, $n = 106$). Thirty six percent of adolescents reported that they rarely engaged in all of the three physical activities. Male respondents are more likely to engage in team sports than the female respondents positive ($p < 0.001$). Finally, the results of the single statement used to assess attitude in the importance of diet and exercise for health indicate that the majority of respondents agree that the diet and exercise are important for health (82.9%, $n = 333$). Overall these results provide important insights into the possible dietary and physical activity behaviour of the adolescents surveyed. These results and their implications are discussed in chapter five.

Chapter 5: Discussion

5.1 Overview

Central to this thesis is the rationale, well supported by literature review in chapter two, that a lifestyle characterised by physical inactivity and consumption that is typical of the “Western” dietary pattern is associated with increased risk of negative health outcomes such as weight gain and increased risk of NCDs. Among adolescents, dietary intake characteristic of the “Western” dietary pattern consumption is associated with increased risk of weight gain and development of NCDs at an unusually young age. In general, overweight adolescents might remain overweight in adulthood and increase their risk of diseases associated with excess weight. The aim of the cross-sectional survey was to investigate selected dietary and physical activity mediators of obesity and overweight in a sample of adolescents attending private high schools in Nairobi that cater to students likely to be from households of middle-income SES and above.

This research is based on the life course perspective (Kuh et al., 2004) and the ANGELO framework (Swinburn et al., 1999), both of which suggest that there might be a link between the changing lifestyle in Kenya and the growing challenge of NCDs. According to the life course perspective, it is necessary to investigate risk factors of NCDs such as unhealthy dietary practices and physical inactivity, and overweight among adolescents because these can persist across the life course into adulthood (Kuh et al., 2004). This thesis therefore sought to investigate in a school setting selected dietary and selected physical activity behaviours, which might mediate overweight among adolescents in Nairobi. According to the ANGELO framework, physical activity and dietary behaviour of adolescents in the school setting might partly reflect the school food and physical activity environment, and the wider school food and physical activity policies (Swinburn et al., 1999).

This chapter discusses the main findings related to dietary behaviour (Section 5.2) and the main findings related to participation in selected sport activities (Section 5.3). Section 5.4 discusses the adolescents’ attitude towards the importance of diet and exercise for health. Lastly, the study limitations and strengths, and research recommendations are discussed in Sections 5.5 and 5.6.

5.2 Consumption of energy dense beverages and foods

Respondents reported the consumption of EDFs and EDBs on a school day, and provided additional information on other dietary items they might have consumed. Regarding the consumption of EDBs, the main finding is that the majority of the adolescents reported the consumption of an EDB at least once in the course of the previous school day (82.3%). From the additional information provided by respondents, it was interesting to note that only a minority of adolescents (break time: 18.7% and lunchtime: 22.6%) reported the consumption of other drinks, with only 12.9 percent reporting the consumption of water at least once on the school day assessed. Another interesting finding is that there was a negative but weak association, which was statistically significant, between the reported consumption of water and EDBs in the course of the single school day. This suggests that the consumption of an EDB displaced the consumption of water and vice-versa. Regarding the consumption of EDFs, the main finding of this thesis was that the majority of the adolescents reported the consumption of an EDF at least once in the course of the previous school day (88.3%). From the additional information provided by respondents, it was interesting to note that only a minority (38.8%) reported that they consumed foods other than the EDFs listed in the questionnaire. It was also interesting to find that among the adolescents who indicated the consumption of other foods, the majority indicated a variety of the mixed meals commonly consumed in Kenya (91%, $n = 142$). Another interesting finding was that there was negative but moderate association, which was statistically significant, between the reported consumption of a “mixed meal” and the consumption of EDFs. This study did not find any significant gender or age group differences in the consumption of EDBs or EDFs. This was not surprising because the actual beverages and foods consumed and their respective portion sizes was not investigated, and was beyond the scope of this study.

While, the findings of this study can be compared to those of Temple et al. (2006), direct comparison is limited due to differences in study design. Temple et al. (2006) investigated the food and beverage purchased by South African adolescents on a previous school day and concluded that the consumption of EDFs and EDBs might be common among adolescents. The information on the dietary choices of the adolescents in the current study, and the food and beverage purchases by adolescents in the study by Temple et al. (2006) provides an insight into the possible dietary behaviour of adolescents within the school environment. A possible explanation for the findings of this study is that the adolescents might have over-reported their intake of EDFs and EDBs because dietary recall was focused on EDBs and

EDFs, and not other foods (Neuhouser et al., 2009). However this is unlikely because this study focused on the intake of supposedly undesirable products and consumption is more likely to be under-reported. The low water consumption among the adolescents is likely to be related to unsafe tap water in Kenya (Onjala, Ndiritu, & Stage, 2013). Most middle and high-income households purchase bottled water for their water consumption needs in various settings such as offices, schools and restaurants (Onjala, Ndiritu, & Stage, 2013). At school, depending on the available opportunities to purchase drinks, adolescents might opt to purchase more palatable drink options such as soda instead of water. These findings regarding a single day's consumption must be interpreted with caution because they do not describe the adolescents' habitual dietary intake (Thompson & Byers, 1994). As has been noted, determination of portion sizes was beyond the scope of this study.

The investigation of a single school day's consumption led to some meaningful findings. First, on the single school day assessed, EDBs and EDFs were accessible and thus consumed by the adolescents who were studied. Therefore, in general, these findings seem to corroborate the ideas of Popkin (1998), that the lifestyle in most developing countries increasingly includes the consumption of energy dense foods and beverages that are high in sugar, fat and, or salt, and less of staple foods and drinks. The findings also revealed that "mixed meals" which are recommended by a number of food based dietary guidelines applicable to Kenya (Namibia Food and Nutrition Guidelines, 2000; Nigeria Food and Nutrition Guidelines, 2003; South Africa Food and Nutrition Guidelines, 2004), were consumed by only a minority of the sample (35.3%, N= 402). Furthermore the findings suggest that on the single school day assessed, the consumption of EDBs and EDF might have displaced the consumption of dietary items such as "mixed meals" and water, which have a lower energy content (Prentice & Jebb, 2003). The displacement of healthier dietary options by energy dense ones is characteristic of nutrition transition (Popkin, 1998).

This thesis also investigated the weekly consumption of selected EDBs and EDFs. The WHO, in its Global Strategy for Diet, Physical Activity and Health (WHO, 2004), recommends the discretionary consumption of foods high in fat, and or sugar. Similar recommendations are provided in the South African food guidelines for adults and children over the age of seven years (South Africa Food Guidelines, 2004), and are generally applicable to Kenya, which has no national dietary guidelines. This thesis is concerned with the frequent consumption of dietary items likely to promote overweight and obesity among adolescents. The main finding

from the assessment of weekly consumption of selected energy dense foods and beverages suggests most of the adolescents frequently consume sugar sweetened beverages (46.5%), and pastries such as biscuits and cakes (38.8%), all of which were grouped in the sweet energy dense items category. Of all the items investigated, the items most frequently consumed were sugar-sweetened beverages (46.5%), followed by pastries, including Kenyan sweet deep-fried dough known locally as ‘mandazi’ (38.8%). Together these findings suggest that the consumption of sweet energy dense dietary items might be more frequent than savoury energy dense items. It was encouraging to find that most of the adolescents reported that they consume the savoury energy dense items investigated only ‘rarely’: ‘pie, samosa, sausage roll, burger, hot dog or pizza’: (52 %), ‘fried chicken or fish (52.7%), and ‘French fries or chips, wedges’ (45.5%). Some gender and age group differences were observed. Male adolescents reported more frequent consumption of French fries and potato wedges than females, and younger adolescents were more likely to report that they frequently consume sweet dietary items in the ‘ice cream, milk shake, chocolate and sweets’ category. However, these trends were not statistically significant. This might be related to the omission of portion sizes in the estimation of intake.

Similar studies conducted in SSA report varied findings. Direct comparison of the findings of these studies is not possible due to the varied study designs and questionnaires, but findings of this thesis nevertheless, contrast with those by Maruapula et al. (2011), who found that among adolescents in Botswana, savoury dietary items such as French fries, cheese pies, potato chips and fried meat were consumed more often than sweet dietary items such as sugar-sweetened beverages, pastries and candy. These varied findings might be related to how intake was assessed. Maruapula et al. (2011) used two categories: savoury dietary items and sweet dietary items, whereas in this thesis savoury and sweet dietary items were further subdivided. No gender differences were observed in the consumption of savoury items among the adolescents studied (Maruapula et al., 2011). However in this thesis, items in the ‘French fries or wedges’ category were reported as consumed more often by boys than girls. Feeley et al. (2009) requested respondents in their study conducted among South African adolescents, to report their weekly consumption of foods they defined only as fast foods. They found that the mean fast-food intake was higher among males than females. In contrast, this thesis used multiple categories to investigate the consumption of energy dense dietary items, which took into account the recent diversification of the fast food industry in Nairobi, Kenya. The individual categories broadly classified as savoury energy dense items comprise fast foods

available from fast food outlets, cafeterias and other convenient food sources. It is suggested that a high intake of fast foods might reflect the recent entry by international fast food outlets into the Kenyan fast food industry (Dixon et al., 2007).

The high consumption of sweet energy dense items is difficult to explain, but it may be related to more opportunities in the school environment to purchase sweet foods and beverages, most of which do not need to be heated prior to consumption as do most savoury foods. The ANGELO framework posits that dietary choices are influenced by the available opportunities to purchase and, or consume food in the physical environment (Swinburn et al., 1999). Another possible explanation for this result is that adolescents who brought food from home to school brought sweet dietary items. The reported consumption of French fries or potato wedge was lower among female adolescents. Female adolescents have been reported as tending to be more conscious about weight gain due to increased awareness about their body image especially shape and size and therefore might limit their dietary intake or under-report their actual intake due to a perceived need for social approval (Livingstone et al, 2004; Shepherd & Dennison, 1996). Younger adolescents in this study were more likely to report that they often consume sweet dietary items in the 'ice cream, milk shake, chocolate and sweets' category and this might be related to the preference for sweet foods declining with age (De Graaf & Zandstra, 1999).

It is important to bear in mind that biased reporting of dietary intake may occur among adolescents due to a perceived need for social approval or subconscious memory lapse especially for dietary items that are socially undesirable such as fast foods (Livingstone et al., 2004). It is however interesting to note that regardless of these possible reporting biases, most of the adolescents in this thesis reported that they frequently consume sweet energy dense items high in sugar and or fat such as sugar sweetened beverages and pastries. One of the socio-cultural environmental influences that emerges from these findings is that, it is likely that social messaging related to dietary consumption in Kenya focuses on the consumption of the typical fast foods available from fast food restaurants such as French fries, pizza and cheese burgers, and omits items that are high in sugar such as pastries and sugar sweetened beverages where discretionary consumption is also recommended such as pastries and sugar rich beverages. According to the ANGELO framework, the socio-cultural environment, which comprises attitudes, perceptions and beliefs regarding dietary items determines what are defined as healthy or unhealthy foods (Swinburn et al., 1999). This thesis assessed the

frequency of consumption of selected energy dense dietary items, thus these findings should be viewed as estimates of intake rather than absolute values.

5.2.1 Sources of meals consumed on a single school day

On the question of the source of the lunchtime meal, the adolescents reported the one source that best described where they obtained the meal they consumed at lunchtime. The main finding was that nearly half of the adolescents who reported a single source of their lunchtime meal, indicated that they obtained this as part of a school provided meal (45.9%). Fast food restaurants and supermarkets, both of which are sources of convenient foods, were not a common source of the lunchtime meals. In one of the five schools surveyed, French fries were offered as a school provided meal. This was interesting because French fries are associated with food sources such as fast food restaurants and other convenience food stores (French et al., 2001). Tuck-shops were a source of food or meal for 15.3 percent of the adolescents studied. An interesting finding was that younger adolescents were more likely to obtain food at lunchtime from a tuck-shop. Possibly related to this, is the finding from the weekly consumption of selected foods (Section 5.2) that younger adolescents were more likely to report the frequent consumption of sweet dietary items in the ‘ice cream, milk shake, chocolate and sweets’ category. A possible explanation is that tuck-shops provide a range of sweet foods, which are preferred by younger students. Preference for sweet foods has been found to decline with age (De Graaf & Zandstra, 1999). An important finding was that as part of the school provided lunch meal, four of the schools surveyed offered a “mixed meal” that comprised a starchy food, vegetables and, possibly animal protein. In one of the schools, the meal offered in the lunchtime recess period also included a staple (Kenyan) starchy food made from maize meal flour. It was interesting to note that none of the adolescents reported consumption of a fruit as part of the school provided meal. In addition to school provided meals, 30.9 percent of the adolescents studied reported that they consumed “mixed meals” brought from home to school. School provided meals are prepared away from home, but they are intended to be healthy meal options for students while they are at school, and are usually prepared in the same way as food prepared at home.

Few studies were found in the literature from SSA on the question of the source of the meal consumed by adolescents at school, at lunchtime. Nevertheless, there are some comparable findings. The findings in this thesis mirror those of a study conducted by Nago et al. (2009).

They investigated the contribution of food prepared away home and food prepared at home among adolescents in secondary schools in Benin, and found that foods prepared at home contributed significantly during lunchtime meals (Nago et al., 2009). The findings by Nago et al. (2009) are somewhat different from those reported by Dapi et al. (2005), who reported that most adolescents in urban settings purchased cheap energy dense food from vendors in the school environment during lunchtime. However, direct comparison with these studies is limited due to study design differences. According to the ANGELO framework, the available opportunities to purchase or consume food and drinks influence individuals' dietary choices (Swinburn et al., 1999). An "obesogenic" environment promotes unhealthy dietary practices and increases the risk of weight gain (Swinburn et al., 1999). As these findings are based on a single school day, the extent of the "obesogenicity" of the five schools surveyed is unclear.

5.3 Weekly participation in selected physical activities in school

The WHO recommends that adolescents should engage in at least 60 minutes of aerobic activities at a moderate intensity daily (WHO, 2011a). Other than during school holidays, adolescents in high school spend a significant amount of time in school each week. One of the objectives of this study was to determine the weekly participation frequency in physical activity by the sub-group of adolescents surveyed using three categories of physical activity available to students in schools. Thirty six percent of adolescents in this study reported that they rarely participate in all the three categories of activities investigated. However, overall the adolescents surveyed in this study are more likely to participate in team sports than individual sports and gym based workouts. A higher proportion of the adolescents reported that they participate in team sports both occasionally and frequently (50.5%) than in individual sports (27.4%) and gym based workouts (26.4%). What is surprising is that the proportion of adolescents who reported that they frequently engage in each of the selected physical activities was low (team sports: 17.7%; individual sports: 10.7%; and gym based workouts: 12.7%). Furthermore, the older adolescents were more likely to either frequently take part in team sports, individual sports and gym based workouts than younger adolescents. The gender differences were such that boys were more likely to participate in team sports and gym based workouts than girls. A possible explanation for gender differences in participation in sports might relate to culture, in that physical exertion during participation in these activities is associated with masculinity, and therefore females are less likely to engage in sport activities that require physical exertion. Direct comparison of the findings of this study and those of two other studies that did not objectively measure physical activity is limited due

to the use of varied study design. Doku et al. (2013) investigated the levels of physical activity among adolescents in Ghana using a four point Likert-type scale where responses were combined into two categories: physically active and not physically active. They found that 69 percent of adolescents in Ghana were physically active and that boys were more likely to report that they were physically active than girls. Peltzer & Pengpid (2011) investigated physical activity among adolescents in Ghana and Uganda, which they defined as any activity that increases heart rate and makes one get out of breath such as running, fast walking, biking, dancing apart from physical education and gym based workouts. They found that 78.5 percent of males and 84.9 percent of females engaged in less than 60 minutes of physical activity on at least five days. This thesis only focused on some of the sport activities available to adolescents in the school environment.

The adolescents in this thesis reported the number of days that they engaged in the selected activities each week. The measurement of the time spent in sports activities and the intensity of the engagement was beyond the scope of this thesis. While this approach provided meaningful information, it also resulted in the insufficient measurement of the various physical activity constructs, which might explain the inability to detect any significant gender and age group differences related to participation in sport activities. Nevertheless, it seems that the majority of adolescents surveyed in this study, particularly girls, are unlikely to meet the recommended level of physical activity especially when school is in session. Further research is required to objectively determine the physical activity levels of adolescents in the school environment.

5.4 Attitude to the importance of diet and exercise for health

The influence of attitudes on health behaviour such as physical activity (Gordon-Larsen, 2001; Sallis, Prochaska & Taylor, 2002) and diet (Gordon-Larsen, 2001; Shepherd & Dennison, 1996) among adolescents has been widely researched. It is thought that health behaviour is associated with attitudes. This study found that the majority of the adolescents surveyed either strongly agreed or agreed that exercise and diet are important for health (82.9%). On the other hand, the findings on the dietary and physical activity behaviour of the adolescents surveyed provide some support for the conceptual premise that there might be a gap between the attitude and the dietary and physical activity behaviours of the adolescents studied in this thesis. It was interesting to note however that none of the studies on the dietary habits and physical activity behaviour of adolescents in SSA reviewed in this thesis (Table 2.3

and Table 2.4), investigated the attitude(s) of adolescents towards diet and physical activity. The gap between the attitude and the behaviours assessed in this thesis might be related to the measurement of attitude applied. According to Krosnick et al. (1993), in addition to perceived importance towards an object(s), for example, diet, exercise and health, attitude has other dimensions such as knowledge, interest in relevant information and certainty, among others. These dimensions are often operationalized as distinct variables as was the case in this thesis, however they are interrelated (Krosnick et al., 1993). Therefore, the attitude of the adolescents was not exhaustively explored in this thesis. However, inclusion of even this limited measure of attitude in this thesis acknowledged that attitude can help in development of educational messages that can lead to dietary change in a population (Thompson & Byers, 1994).

5.5 Study Limitations and Strengths

A number of important limitations and compromises need to be considered. First, this thesis was not representative of the entire population from which the sample is drawn as this study was limited to more affluent groups, however, unhealthy dietary behaviours among low socio-economic groups in Nairobi have been reported (van 't Riet et al., 2001). Furthermore, a convenience sample was used in this thesis. Due to slow and low response rates by school principals in assenting to this research, and also the limited access granted to the students in the five schools surveyed, convenience sampling which is fast and inexpensive (Battaglia, 2008), was most suitable. This sampling technique also fostered the engagement of the adolescents surveyed and ensured that their participation was voluntary and free from coercion. This sampling technique is useful for the rapid exploration of a hypothesis, before definitive research that makes use of a probability sampling technique can be carried out Battaglia (2008).

A second limitation was the inability to get reliable height and weight data. As noted in section 3.7.2, some of the school principals assented to voluntary measurement of the adolescents' height and weight. However as noted in section 3.11, the response by students to obtain their measurement was low. Therefore the association between body weight status and the behaviours assessed was not assessed.

A third limitation was the lack of specific nutritional and physical activity data relevant to Kenya. A questionnaire was developed for this thesis, however its validation was not possible

owing to the complexity of questionnaire validation in dietary (Block & Hartman, 1989) and physical activity (Wolf et al., 1994) studies, which rely on the use of reference methods to measure the extent of agreement between the various assessment methods. Also, a number of compromises in the scope and quality of data were made in order to facilitate data collection. Portion sizes and amount of time were not included in the assessment of dietary intake and physical activity participation respectively. Whereas this approach may have resulted in insufficient measurement of the various dietary and physical activity constructs, it enabled the exploration of dietary and physical activity behaviours among the sample. The behaviours in this study are complex and their comprehensive measurement was beyond the scope of this thesis.

A significant strength of this thesis is that it has provided for the first time preliminary evidence that suggests that there is urgent need for further research on the dietary and physical activity behaviours of adolescents. Particularly, research using an ecological approach can shed light on some of the environmental influences of settings such as school, neighbourhood and home in the dietary and physical activity behaviour of adolescents.

Another significant contribution of this study is that it offers some practical lessons regarding how to engage with Kenyan schools in research. The recruitment process emphasized that multiple approaches are required to make school principals more receptive first to scheduling an in-person meeting and second, to assenting to the research. In this thesis, school principals were contacted by telephone, email, and study documents were hand-delivered to schools before an appointment was granted. Also it is essential to emphasize that the school setting is not merely a convenient place to recruit participants but is an important “built” environment that influences the dietary and physical activity behaviour of adolescents. According to the ANGELO framework, depending on the opportunities to consume food and to engage in physical activity, physical environments are influential in the development of overweight and obesity (Swinburn et al., 1999).

5.6 Recommendations and conclusion

This thesis has provided preliminary evidence, which raises a number of questions in need of further investigation. Overall, the findings of this thesis provide insight into the dietary and physical activity behaviour of a sub-group of adolescents in Nairobi, Kenya within the school environment.

A number of recommendations arise from this thesis for both research and health promotion opportunities. It is recommended that research be undertaken among a representative sample of adolescents in two broad areas: the measurement of dietary, exercise and other related constructs, and the assessment of the environmental influences of dietary and physical activity behaviour. For the rigorous measurement of diet and exercise, the development of a validated food frequency questionnaire and physical activity questionnaire is suggested. These questionnaires should include an assessment of energy intake and expenditure. In addition to the rigorous assessment of dietary and exercise constructs, the objective measurement of body weight status is suggested preferably using multiple anthropometric assessment techniques as this might also allow the validation of the use of BMI among the ethnically diverse adolescents of Kenya. Also, the measurement of knowledge, attitude, attitude and values associated with diet and physical activity is suggested as this might influence diet and physical activity related behaviours. Regarding the assessment of environmental influences it is suggested that the opportunities to eat or drink in the school setting, including the school food and exercise policies, and the role of the home environment in the dietary and physical activity behaviour of adolescents are assessed. Lastly, it is suggested that subsequent research determine whether there are any association(s) between the constructs highlighted above and environmental influences.

This thesis has explored among a sub-group of adolescents in Kenya the engagement in selected dietary and physical activity behaviours believed to increase the risk of overweight. This thesis used the life course perspective to argue that part of projected increase in the prevalence of NCDs in Kenya might originate from unhealthy dietary behaviour and physical inactivity among adolescents. The school setting was identified as an important setting where adolescents might develop health risk behaviours and the ANGELO framework provided a rationale for investigating dietary and physical activity behaviour among adolescents in the school environment. Future studies can be followed by recommendations for the development and implementation of school food and physical activity policies in the schools surveyed. On a national level, a subsequent research study can be used to develop national dietary guidelines for adolescents in Kenya and a national school policy for diet and physical activity.

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Appendices

Appendix A: Search strategy

(Dietary and physical activity studies among adolescents in SSA)

Diet and adolescents in Sub-Saharan Africa (SSA)

EMBASE search strategy

1. feeding behavior/ or drinking behavior/ or eating habit/ or food preference/ (104907)
2. ((food or diet*) adj3 (habit* or preference*)).tw. (14821)
3. 1 or 2 (113839)
4. adolescent/ (1256006)
5. (youth* or teen* or adolesc*).tw. (249712)
6. (4 or 5) and 3 (16019)
7. limit 3 to adolescent <13 to 17 years> (14402)
8. 6 or 7 (16019)
9. exp "Africa south of the Sahara"/ (146791)
10. (south africa or kenya).af. (153350)
11. 9 or 10 (249331)
12. 8 and 11 (356)
13. limit 12 to english language (332)

MEDLINE search strategy

1. exp Food Habits/
2. Food Preferences/
3. ((food or diet*) adj3 (habit* or preference*)).tw.
4. 1 or 2 or 3
5. exp "Africa South of the Sahara"/
6. south africa.af.
7. 5 or 6
8. 4 and 7
9. limit 8 to "adolescent (13 to 18 years)"
10. Adolescent/
11. (youth or teen* or adolesc*).tw.
12. 10 or 11
13. 8 and 12
14. 9 or 13
15. limit 14 to english language

Physical activity and adolescents in SSA

MEDLINE search strategy

1. physical activity.mp.
2. exp Exercise/
3. 1 or 2
4. exp Adolescent/
5. 3 and 4
6. exp "Africa South of the Sahara"/
7. 5 and 6

Appendix B

- 1a. University of Canterbury (UC) ethics approval
- 1b. UC ethics approval amendment 1
- 1c. UC ethics approval amendment 2
- 1d. UC ethics approval amendment 3
- 2. AMREF Kenya ethics approval
- 3. Kenya Government research permit
- 4. School A: Principal consent
- 5. School B: Principal consent
- 6. School C: Principal consent
- 7. School D: Principal consent
- 8. School E: Principal consent
- 9. School F: Principal consent
- 10a. Confidentiality agreement (Female research assistant)
- 10b. Confidentiality agreement (Male research assistant)

1a. *University of Canterbury ethics approval*



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/44

29 May 2013

Zipo Mugwang'a
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Zipo

The Human Ethics Committee advises that your research proposal "Understanding the dietary, physical activity habits and body weight distribution among adolescents in Nairobi" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your emails of 20 and 24 May 2013.

Best wishes for your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair
University of Canterbury Human Ethics Committee

1b. *University of Canterbury ethics approval (Ammendement 1)*



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/44

17 July 2013

Zipo Mugwang'a
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Zipo

Thank you for your request for an amendment to your research proposal "Understanding the dietary, physical activity habits and body weight distribution among adolescents in Nairobi" as outlined in your email dated 10 July 2013.

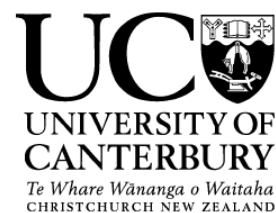
I am pleased to advise that this request has been considered and approved by the Human Ethics Committee.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair, Human Ethics Committee

1c. University of Canterbury ethics approval (Amendment 2)



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/44 – Amendment 2

9 August 2013

Zipo Mugwang'a
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Zipo

Thank you for your request for an amendment to your research proposal “Understanding the dietary, physical activity habits and body weight distribution among adolescents in Nairobi” as outlined in your email dated 8 August 2013.

I am pleased to advise that this request has been considered and approved by the Human Ethics Committee.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair, Human Ethics Committee

1d. *University of Canterbury ethics approval (Amendment 3)*



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/44 – Amendment 3

16 September 2013

Zipo Mugwang'a
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Zipo

Thank you for your request for an amendment to your research proposal “Understanding the dietary, physical activity habits and body weight distribution among adolescents in Nairobi” as outlined in your email dated 13 September 2013.

I am pleased to advise that this request has been considered and approved by the Human Ethics Committee.

Yours sincerely

A handwritten signature in black ink, appearing to read 'L. MacDonald'.

Lindsey MacDonald
Chair, Human Ethics Committee

2. AMREF Kenya ethics approval



African Medical and Research Foundation
Kenya

Ref: AMREF-ESRC P73/2013

6th August 2013

Ziporah Mugwang'a, (Principal Investigator),
Post Graduate student, University of Canterbury,
Christchurch 8140,
Tel: +64221732413
Email: Zipo.mugwanga@pg.canterbury.ac.nz

Dear Ziporah,

**RESEARCH PROTOCOL: 'UNDERSTANDING THE DIETARY, PHYSICAL ACTIVITY HABITS,
AND BODY WEIGHT DISTRIBUTION AMONG ADOLESCENTS IN NAIROBI.'**

Thank you for submitting your research protocol to the AMREF Ethics and Scientific Review Committee (ESRC).

This is to inform you that the ESRC has reviewed and approved your above protocol. The approval period is from 6th August 2013 to 6th August 2014.

The approval is subject to compliance with the following requirements:

- a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b) All changes (amendments, deviations, violations etc) are submitted for review and approval by AMREF ESRC before implementation.
- c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the ESRC immediately.
- d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to AMREF ESRC immediately.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period (attach a comprehensive progress report to support the renewal).
- f) Clearance for export of biological specimens must be obtained from AMREF ESRC for each batch of shipment.
- g) Submission of an executive summary report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

Please do not hesitate to contact the ESRC Secretariat (esrc.kenya@amref.org) for any clarification or query.

Yours faithfully,

Dr. Mohamed Karama
Chair, AMREF ESRC

Cc. Dr. Meshack Ndirangu, Deputy Country Director, AMREF in Kenya and Vice Chair AMREF ESRC
Dr. David Ojaka, Programme Manager Research Advocacy and Business Development

3. Kenya Government research permit

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
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Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/12A/013/124**

Date: **20th August 2013**


Ziporah Mugwang'a
University of Canterbury
New Zealand.

RE: RESEARCH AUTHORIZATION

Following your application dated **30th July, 2013** for authority to carry out research on "*Understanding the Dietary, Physical Activity Habits and Body Weight Distribution among Adolescents in Nairobi.*" I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **30th September, 2013.**

You are advised to report to **the County Commissioner and County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

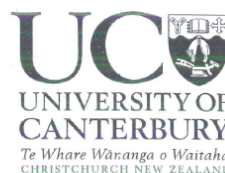

DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The County Commissioner
The County Director of Education
Nairobi County.

4. School A: Principal consent

Ziporah Mugwang'a
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NZ mobile: +64 22 1732413
Kenya mobile: +254 724 609892
Email: zipo.mugwanga@pg.canterbury.ac.nz



Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I also understand that my consent is not a guarantee of the student's participation and that the students are to participate voluntarily.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

I understand that there will be no way to identify the school, nor its students from the questionnaires and from the pool of questionnaires from other schools.

I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I approve the school's participation in this project

Name: GEORGE A. OMARA

Date: 12th September 2013

Signature: [Signature]

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz

5. School B: Principal consent

Ziporah Mugwang'a
School of Health Sciences
NZ mobile: +64 22 1732413
Kenya mobile: +254 724 609892
Email: zipo.mugwanga@pg.canterbury.ac.nz



Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

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I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students and their parents.

Due to the low risk associated with the study, and the measures that have been put in place to mitigate any possible risks, I am issuing overall consent for the students to participate in the study, however the researcher is to issue information sheets to parents for their information.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I consent the students' participation in this project

Name: Benedict Okeno

Date: 13th September, 2013

Signature: [Signature]



6. School C: Principal consent

Ziporah Mugwang'a
School of Health Sciences
NZ mobile: +64 22 1732413
Kenya mobile: +254 724 609892
Email: zipo.mugwanga@pg.canterbury.ac.nz



Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

I understand that there will be no way to identify the school, nor its students from the questionnaires and from the pool of questionnaires from other schools.

I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students and their parents.

Due to the low risk associated with the study, and the measures that have been put in place to mitigate any possible risks, I am issuing overall consent for the students to participate in the study, however the researcher is to issue information sheets to parents for their information.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I consent the students' participation in this project

Name: Grace Muriuki

Date: 17-09-2013

Signature: [Signature]



P. O. Box 14538 - 00800
WESTLANDS, NAIROBI
Tel: 4442634 / 2523945

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz

7. School D: Principal consent

Ziporah Mugwang'a
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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution

among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I also understand that my consent is not a guarantee of the student's participation and that the students are to participate voluntarily.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

I understand that there will be no way to identify the school, nor its students from the questionnaires and from the pool of questionnaires from other schools.

I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I approve the school's participation in this project

Name: Leon Barham

Date: 10/09/2013

Signature: [Signature]

8. School E: Principal consent

Ziporah Mugwang'a
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NZ mobile: +64 22 1732413
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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

I understand that there will be no way to identify the school, nor its students from the questionnaires and from the pool of questionnaires from other schools.

I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students and their parents.

Due to the low risk associated with the study, and the measures that have been put in place to mitigate any possible risks, I am issuing overall consent for the students to participate in the study, however the researcher is to issue information sheets to parents for their information.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I consent the students' participation in this project

Name:

Gerald Mamer

Date:

24/9/2013

Signature:

[Signature]



9. School F: Principal consent

Ziporah Mugwang'a
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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Consent Form for School Principals

I have been given a full description of this project and I have been given an opportunity to ask questions.

I also understand that my consent is not a guarantee of the student's participation and that the students are to participate voluntarily.

I understand that it is only after I allow that the school's students can be approached to participate. If I consent, I have the right to withdraw the school's participation from the study at any time without penalty.

I understand that there will be no way to identify the school, nor its students from the questionnaires and from the pool of questionnaires from other schools.

I understand that the researcher will also take care to ensure the school's confidentiality in the publication of the findings.

I understand that the completed questionnaires will be kept in locked and secure storage at the University of Canterbury then be destroyed after five years.

I understand that I will receive a report on the study that I may share with my students.

I understand that if I require further information I can contact Ziporah Mugwang'a. If I have any complaints I can contact the Chair of the University of Canterbury Research Human Ethics Committee or the AMREF Ethics Committee (esrc.kenya@amref.org).

By signing below, I approve the school's participation in this project

Name: MARGARET A. MASIME

Date: 10.9.2013

Signature: 
Deputy-Principal

10a. Confidentiality agreement (Female research assistant)

Ziporah Mugwang'a
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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Confidentiality Agreement for Research Assistants

As a member of this research team I understand that I may have access to confidential information about sites and participants in this study. By signing this statement, I am indicating my understanding of my responsibilities to maintain confidentiality and agree to the following:

- I understand that names and any other identifying information about study sites and participants are completely confidential.
- I agree not to divulge, publish, or otherwise make known to unauthorized persons or to the public any information obtained in the course of this research project.
- I understand that all information about study sites or participants obtained or accessed by me in the course of my work is confidential. I agree not to divulge or otherwise make known to unauthorized persons any of this information.
- I understand that I am not to read information about study sites or participants, or any other confidential documents, nor ask questions of study participants for my own personal information but only to the extent and for the purpose of performing my assigned duties on this research project.
- I agree to notify the project manager/principal investigator immediately should I become aware of an actual breach of confidentiality or a situation which could potentially result in a breach, whether this be on my part or on the part of another person.


Name: Emmie Indiani

Date: 27/08/2013

Signature: 

Name of Investigator: Ziporah Mugwang'a

Date: 27/08/2013

Signature: 

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz

10b. Confidentiality agreement (Male research assistant)

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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi Confidentiality Agreement for Research Assistants

As a member of this research team I understand that I may have access to confidential information about sites and participants in this study. By signing this statement, I am indicating my understanding of my responsibilities to maintain confidentiality and agree to the following:

- I understand that names and any other identifying information about study sites and participants are completely confidential.
- I agree not to divulge, publish, or otherwise make known to unauthorized persons or to the public any information obtained in the course of this research project.
- I understand that all information about study sites or participants obtained or accessed by me in the course of my work is confidential. I agree not to divulge or otherwise make known to unauthorized persons any of this information.
- I understand that I am not to read information about study sites or participants, or any other confidential documents, nor ask questions of study participants for my own personal information but only to the extent and for the purpose of performing my assigned duties on this research project.
- I agree to notify the project manager/principal investigator immediately should I become aware of an actual breach of confidentiality or a situation which could potentially result in a breach, whether this be on my part or on the part of another person.

Name: Abraham Juma

Date: 29/08/2013

Signature: [Signature]

Name of Investigator: Ziporah Mugwang'a

Date: 29-08-2013

Signature: [Signature]

Appendix C

1. Information sheet for school principals
2. Briefing sheet for students
3. Information sheet for students
4. "Healthy weight leaflet"

1. Information sheet for school principals

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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Information Sheet for School Principals/School Board of Directors

I am a Master of Health Science student at the University of Canterbury, New Zealand. My Master's thesis is a study to identify the dietary and physical activity habits, and body weight distribution among adolescents in Nairobi. This study will generate some knowledge on the dietary and physical activity habits of this age group. Also it may generate information that could establish the relationship various dietary and physical activity habits may have on body weight distribution. All together the knowledge generated could be useful in the provision of better health care for adolescents in Kenya.

I would like to invite your students to participate in my study. If you approve of your students participation in the study, the next step will be for me to seek the consent of their parents in addition to the students' assent. Project information sheets for both the parents and the students will be provided to ensure that consent and assent is informed. Please note that it is only with your approval that your students can participate. If you do approve, you have the right to withdraw your school's participation from the study at any time without penalty.

The students who will participate in the study will be required to complete a confidential questionnaire that will take approximately 5-10 minutes. The questionnaire will seek to understand the adolescents':

Dietary and physical activity habits

Thoughts regarding dietary habits, physical activity and health

In addition, I have two assistants (1 male for the boys and 1 female for the girls) to assist the students to obtain their height and weight measurements in private. All students' information will be treated as confidential and I will not be able to identify any student from it.

A healthy weight information leaflet will be available with instructions for students with concerns about their weight. The leaflet instructs the students to seek counsel of [name of nutritionist], the study's nutritionist who will be available to them on the day they complete the questionnaires

There will be no way to identify your school, nor its students from the questionnaires or from the pool of questionnaires from other schools. No names will be required on any of the questionnaires, and this will be communicated to the students. The completed confidential questionnaires will only be accessible to me and to my thesis supervisors (Dr. Arindam Basu, Assoc. Prof Pauline Barnett and Dr. Elizabeth Kimani). I will ensure the confidentiality of the school and the students in reporting of the findings. During the project all the data will be securely stored in a password protected computer and locked storage at the University of Canterbury. The data will be retained in the locked storage at the University of Canterbury for five years following the study then be destroyed.

My Master's thesis will be available to the public through the university's database. I may also publish the results in order that other interested people may learn from my research. You will receive a report on the study that you may share with your students and their parents.

If you have any questions about the study, please contact me. AMREF and the University of Canterbury, Human Ethics Committees have approved this study, (HEC 2013/44). If you have a complaint about the study, you may contact the Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (humanethics@canterbury.ac.nz) or the AMREF Ethics Committee (esrc.kenya@amref.org).

If you approve to your school's participation in this study, I will request you to sign an approval form later on during a face-to-face meeting to be arranged in August 2013.

I am looking forward to working with your school and thank you in advance for your approval.

Ziporah Mugwang'a

2. Briefing sheet for students

Ziporah Mugwang'a
School of Health Sciences
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Email: zipo.mugwanga@pg.canterbury.ac.nz



Understanding The Dietary and Physical Activity Habits, and Body Weight Distribution Among Adolescents in Nairobi

Briefing Sheet for Students

My name is Ziporah Mugwang'a and I am a Master of Health Science student at the University of Canterbury, New Zealand. As part of my studies, I am conducting a research study to identify the dietary and physical activity habits, and body weight distribution among students between the ages of 13 and 18 in Nairobi.

I would like to invite you to participate in this study. Your participation is voluntary. The study will require you to complete an anonymous questionnaire on your dietary habits and physical activity habits. You will also be requested to indicate your height and weight. There will be no way to identify you from any completed questionnaire, because you will not be writing your names on the questionnaire.

I have two assistants [introduces the two research assistants] who are trained nutritionists. They will be available in your school from today to tomorrow at midday to assist you to voluntarily determine your height and weight. The questionnaire you will complete asks you to reveal these measures. I would recommend that even if you do not wish to participate in the study, you get to know your height and weight. The research assistants will issue 'healthy weight' leaflets and address any concerns that may arise regarding your measurements.

If you wish to participate, or you want to ask some questions about the project feel free to come over to [insert location that will have been assigned by school principal to set up a recruitment desk] during your break periods. When you come over I will issue you a big envelope with an information sheet attached on it. Please read the information sheet, it will have information on the project. Inside the envelope, there will a questionnaire. Kindly complete the questionnaire by tomorrow midday and return it to [location where recruitment desk is set up].

I have the permission and consent of your school principal to request your participation. If you wish to participate in this study, kindly come over to [insert location that will have been assigned by school principal to set up a recruitment desk] during your break periods. I am looking forward to working with each one of you in my research study. Thank you

Ziporah Mugwang'a

3. Information sheet for students

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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Information Sheet for Students

My name is Ziporah Mugwang'a and I am a Master of Health Science student at the University of Canterbury, New Zealand. As part of my studies, I am conducting a research study to identify the dietary habits and physical activity habits of students between the ages of 13 and 18 in Nairobi.

Before you participate kindly read this information sheet. Please note that your participation in this study is voluntary. You have the right to withdraw from the study at any stage without penalty. Kindly also take the information sheet titled "Information sheet to your parents/guardians", so that they are aware of your participation. Kindly sign the questionnaire as requested, to confirm that your participation is voluntary. With your participation, the results of this research could be used to provide better health care for adolescents in Kenya.

I would like to invite you to voluntarily complete an anonymous 5-10 minute questionnaire. The questionnaire seeks to understand adolescents':

Dietary and physical activity habits, and

Thoughts regarding dietary habits, physical activity and health

Also, I would like you to report your weight and height. I have two assistants (1 male for the boys and 1 female for the girls) to assist you obtain these measurements in private if you do not have them already. Your information will be treated as confidential and I will not be able to identify you from it. The assistants are qualified nutritionists and will be able to counsel you if you have concerns regarding diet and exercise.

There will be no way to identify you from the questionnaires. No names will be required on any of the questionnaires. A unique random number will be used to identify you. The completed confidential questionnaires will only be accessible to me and to my project supervisors (Dr. Arindam Basu, Assoc. Prof Pauline Barnett and Dr. Elizabeth Kimani). I will ensure your confidentiality, and that of your school in reporting of the findings. During the project all the data will be securely stored in a password-protected computer and locked storage at the University of Canterbury. The data will be retained in the locked storage at the University of Canterbury for five years following the study then be destroyed.

The results of this study will be available to the public through my university's database. I may also share the results with other interested people so they may learn from my research. A report on the findings of this study will be available to you through your school principal.

If you have any questions about the study, please contact me. AMREF and the University of Canterbury, Human Ethics Committees have approved this study, (HEC 2013/44). If you have a complaint about the study, you may contact the Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (humanethics@canterbury.ac.nz) or the AMREF Ethics Committee (esrc.kenya@amref.org).

I am looking forward to working with you and thank you in advance for your participation.

Ziporah Mugwang'a

4. "Healthy weight leaflet"

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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Healthy Weight Leaflet

Are you concerned your weight is too low or high? A healthy weight is unique for each person. To determine your healthy weight or to have concerns about your weight addressed, please come to the recruitment desk and seek advice from [John Doe either in person or on john.doe@johndoe.com or on 123456].

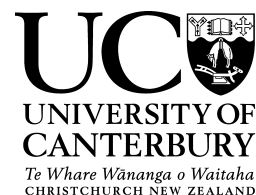
Appendix D

Questionnaire

Appendix E

Height and weight data sheet

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Understanding the Dietary and Physical Activity Habits, and Body Weight Distribution among Adolescents in Nairobi

Weight in centimeters

Weight in Kilograms

Appendix F

Study variables and coding

Study variables and coding

Characteristic	Variables ¹	Coding
Dietary assessment	Consumption on the previous school day at break time of: Fruit flavoured juice Beverages Flavoured milk beverages Water (secondary variable) Other drinks ² (secondary variable) Consumption on the previous school day at lunchtime of: Fruit flavoured juice Beverages Flavoured milk beverages Water (secondary variable) Other drinks (secondary variable)	1=drink item consumed 0= drink item not consumed
	Consumption on the previous school day at break time of: Chocolates/sweets or Ice cream Biscuits/cake/Muffin/Doughnut or Mandazi Potato crisps/Corn chips/Popcorn French fries/Chips/Wedges Burger/Pizza/PIE/Samosa/Hotdog Fruits and vegetables (Secondary variable) Other food ³ (secondary variable) Consumption on the previous school day at lunchtime of: Chocolates/sweets or Ice cream Biscuits/cake/Muffin/Doughnut or Mandazi Potato crisps/Corn chips/Popcorn French fries/Chips/Wedges Burger/Pizza/PIE/Samosa/Hotdog Fruits and vegetables (Secondary variable)	1=drink item consumed 0= drink item not consumed

¹ Unless stated in parentheses, the variable is a primary study variable

² Other drinks are all the beverages that were too few to be categorized on own, they were not energy dense.

³ Other foods are items that could not be recoded into existing categories and were too few to be categorized on own

Characteristic	Variables ¹	Coding
	Mixed meal ¹ at lunchtime on the previous school day (Secondary variable)	
	Weekly consumption of: Pie/Samosa/Sausage Roll/Burger/Hot Dog/Pizza Fried Chicken Or Fish Consumption of French Fries/Chips/Wedges Biscuits/Cake/Mandazi/Crisps Ice Cream/Milk Shake/Chocolate/Sweets Sweet Beverages E.g. Soda, Squash, Flavoured Water	1=Never 2=Once per week 3=2-3 times per week 4=4-5 times per week 5=6-more than 6 times per week. 0 = NO RESPONSE Recoded as follows: Rarely = Never and Once per week
	Supermarket School meal Home as home-made meal Tuck-shop School as school provided lunch	1=Yes 0= No
Physical activity assessment	Participation in: A team sport e.g. Football, basketball Individual sport e.g. Athletics, singles tennis Treadmill or gym class such as spin	1=Never 2=Once per week 3=2-3 times per week 4=4-5 times per week 5=6-more than 6 times per week. 0 = NO RESPONSE Recoded as follows: Rarely = Never and Once per week

¹ Mixed meals are meals that comprise a variety of food groups such as starchy foods such as rice, pasta, potatoes or staple starches, which form the larger part of the meal, and are balanced by adding vegetables and a source of protein such as chicken, beef or soya. Mixed meals are usually consumed three times a day at breakfast, lunch and supper. Some schools provide a mixed meal in the middle of the school day usually as lunch.

Characteristic	Variables ¹	Coding
General belief regarding the importance of diet and exercise for health	'Diet and exercise are important for health'	1=Strongly disagree 2=Disagree 3=Neither agree nor disagree 4=Agree 5=Strongly disagree 0= NO RESPONSE
Other details	Age in years Gender Weight Height	

Appendix G

1. Percentage distribution of other beverages and drinks specified as consumed by respondents in two school recess periods (break time and lunchtime)
2. Other foods and snacks specified by respondents at break time
3. Other foods and snacks specified by respondents at lunchtime
4. Meals provided as school provided lunches in the five schools

1. Percentage distribution of other beverages and drinks consumed

Table G1: *Percentage distribution of other beverages and drinks specified as consumed by respondents in two school recess periods (break time and lunchtime)*

Respondents' responses (Beverages or drinks specified)		
	Break time	Lunchtime
Water	75(18.7)	91(22.6)
Coffee, Tea	8(2)	0
Fresh home-made juice	2(0.5)	1(0.2)
Yoghurt	3(0.7)	0
Plain milk	1(0.2)	0
Maize meal porridge ¹	4(1)	1(0.2)
Respondent <u>did not</u> specify other beverage(s)	309(76.9)	309(76.9)

Note:¹Maize meal porridge is fluid drink made out maize flour and has a runny consistency that can be purchased as an instant drink reconstituted by adding hot water to the maize flour, or prepared from the basic ingredients: maize flour and water.

2. Other foods and snacks specified by respondents at break time

Table G2: Other foods and snacks specified by respondents at break time

Foods and snacks specified by respondents	n(%)
Vegetables and fruits	16(4)
Sandwich ¹	14(3.5)
Chapati ²	4(1)
Bread/ scone	3(0.7)
Cereal bar	1(0.2)
Respondent did not specify other food(s) or snack(s)	364(90.5)

Note: ¹Sandwiches reported include vegetable, ham, chicken and turkey sandwiches

²Chapati is pan-fried unleavened bread made from wheat flour usually eaten on own or as an accompaniment alongside a vegetarian or non-vegetarian curry.

3. Other foods and snacks specified by respondents at lunchtime

Table G3: Other foods and snacks specified by respondents at lunchtime

Foods and snacks specified by respondents	n (%)
Various mixed meals ¹	142(35.3)
Sandwich ²	11(2.7)
Fruits and vegetables	5(1.2)
Respondent did not specify other food(s) or snack(s)	244(60.7)

Note: ¹Mixed meals are typical in Kenya and comprise a starchy food, vegetables and or a source of protein.

²Sandwiches reported include vegetable, ham, chicken and turkey sandwiches.

4. Meals provided as school provided lunches in the five schools

Table G4: Meals provided as school provided lunches in the five schools

School	Meal provided
School A	Rice or Ugali ¹ and vegetable curry or beef curry
School B	Spaghetti or chapati ² and beef curry
School C	French fries
School D	Pasta and chicken curry
School E	Rice or fried rice and mutton curry

Note: Apart from school A, all the schools provided a meal that can be considered a mixed meal according to the South African food guidelines

¹Ugali is a Kenya starchy meal that is made from maize flour to a doughy consistency and is eaten as an accompaniment alongside a vegetarian or non-vegetarian curry

²Chapati is pan-fried unleavened bread made from wheat flour usually eaten on own or as an accompaniment alongside a vegetarian or non-vegetarian curry.

